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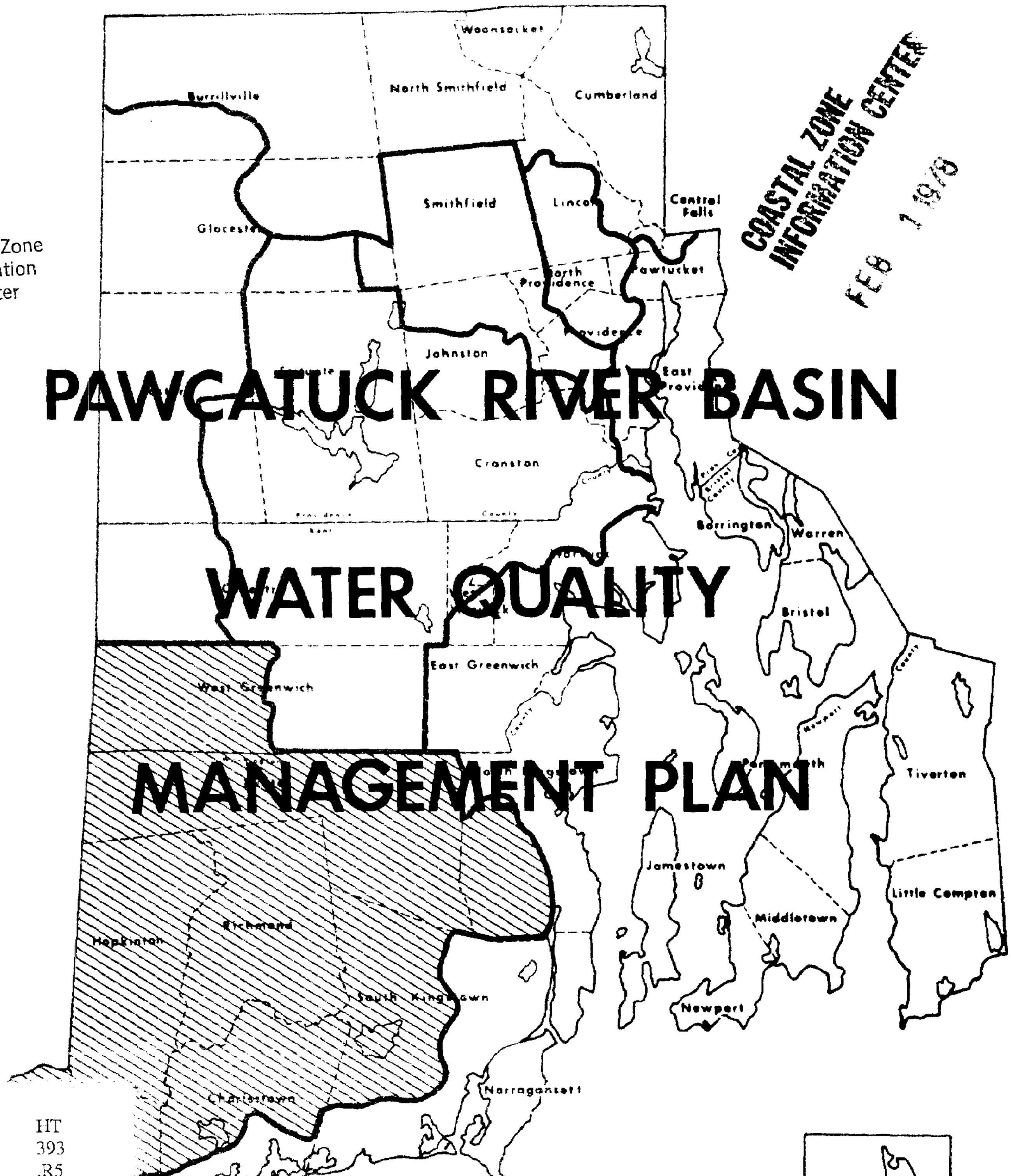
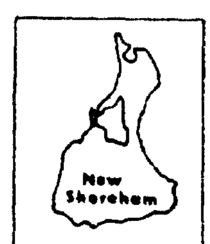


PAWCATUCK RIVER BASIN

WATER QUALITY

MANAGEMENT PLAN



PREPARED BY

ISLAND STATEWIDE PLANNING PROGRAM
AND
RHODE ISLAND DEPARTMENT OF HEALTH

Rhode Island Statewide Planning Program

The Rhode Island Statewide Planning Program, a division of the Department of Administration, is the central planning agency for state government. The work of the Program is guided by the State Planning Council, comprised of state, local, public, and federal representatives. The objectives of the Program are to plan for the physical, economic, and social development of the state; to coordinate the activities of governmental agencies and private individuals and groups within this framework of plans and programs; and to provide planning assistance to the Governor, the General Assembly, and the agencies of state government.

Program activities are assisted by federal grants through the Integrated Grant Administration Program and by direct grants. The contents of this report reflect the views of the Statewide Planning Program, which is responsible for the accuracy of the facts and data presented herein. The contents do not necessarily reflect the official views or policies of the sponsoring agencies.

WATER QUALITY MANAGEMENT PLAN

for the

PAWCATUCK RIVER BASIN

Prepared Pursuant to
Title III Section 303e
Federal Water Pollution Control Act
Amendments of 1972

August, 1976

Prepared by

RHODE ISLAND STATEWIDE PLANNING PROGRAM

and

RHODE ISLAND DEPARTMENT OF HEALTH

FEB 1 1978

COASTAL ZONE

STATE OF RHODE ISLAND
AND PROVIDENCE PLANTATIONS

Honorable Philip W. Noel, Governor

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PREFACE

The Pawcatuck River Basin Water Quality Management Plan presented herein was prepared pursuant to Title III, Section 303(e) of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). According to guidelines published by the U.S. Environmental Protection Agency in September 1974, "... the basin plan is a management document that identifies the basin's water quality problems and sets forth a remedial program to alleviate those problems."

The goals of the plan are those established in the State Guide Plan: (1) to reduce stream pollution to levels set in the state's stream classification plan, and (2) to coordinate development, conservation and use of the state's water resources. This plan is one of seven water quality management plans (Blackstone, Moosup, Moshassuck, Narragansett, Pawcatuck, Pawtuxet and Woonasquatucket) which in total will constitute the water quality element of the State Guide Plan.

Because water pollution is a problem which transcends local community boundaries, the water quality management plan must consider pollution problems and abatement programs from a basinwide rather than strictly local perspective. The plan provides the foundation for an orderly quality management program by:

(1) Determining existing water quality, identifying point sources of pollution, and assigning applicable water quality standards to the waters of the basin.

(2) Assessing water quality and abatement needs in order to establish priorities for awarding construction grants.

(3) Setting compliance schedules or target abatement dates, and coordinating the national pollutant discharge elimination system permit program with these schedules.

(4) Identifying needs and priorities for facilities planning (Section 201 of PL 92-500) and areawide wastewater treatment management planning (Section 208 of PL 92-500).

To facilitate identification of water quality problems and the establishment of priorities, the river has been divided into segments according to water quality standards and classifications established by the Division of Water Pollution Control of the Rhode Island Department of Health. These segments are then further classified as "water quality limited" or "effluent limited" segments depending on the degree of treatment required to meet the Health Department standards. In order to meet water quality standards, limits on pollutant loadings have been allocated to dischargers along these segments. These limits are termed "waste load allocations" and are based on the assimilative capacity of the segment and on the uses designated for the segment, as determined by the Rhode Island Department of Health.

Priorities have been assigned to all the segments and for construction grants based on the severity of pollution in the segments. Recommendations have been made for a pollution abatement facilities construction program and for further, more extensive planning under Section 201 and 208 of PL 92-500.

The background information on population trends and suggested land use patterns provides a framework for estimating future trends and needs over a twenty year period. Construction and planning activities recommended in the plan are for a five year period. The plan will be revised every five years to establish water quality goals and construction programs for the next five year period. Annual revisions will be made to include changes in pollution sources, the results of water quality monitoring and surveillance programs, and information and recommendations from other planning activities.

Plan Format

The basin boundary used in this plan differs from the natural hydrologic boundary of the basin. The adjusted basin boundary coincides with the boundaries of the nearest "analysis zones." These analysis zones, which are subdivisions of census tracts, were developed by the Statewide Planning Program to provide interpolated demographic data at a finer "grain" than that possible with census tracts. Adjustment of the basin boundary in this manner made the compilation of demographic, surface area and other quantitative data a manageable task, while maintaining reasonable accuracy. Both the hydrologic and adjusted basin boundaries are shown on the basin maps.

This document incorporates a simple and efficient system for identifying source materials consulted. This scheme replaces the usual numbered footnotes placed at the bottom of text pages or in a separate list at the end of the document. Instead, numbers in double parentheses, e.g. ((5:27)), follow the quoted or paraphrased material in the text. The first number (5, in this case) refers to reference number 5 listed in the BIBLIOGRAPHY. The number following the colon (27, in this case) refers to page number 27 in reference number 5. If a portion of the text is taken from several pages of a reference, the notation in the text would be: ((18:12, 30-33)), where pages 12 and 30 through 33 of reference number 18 have been summarized. If material in the text has been derived from more than one source, the notation would be ((26,47)), where references number 26 and number 47 have been used. Occasionally, a reference will have no page numbers, in which case a section, table or other feature will be cited, e.g.: ((50: Table 6)) or ((35: Sec. IIA)).

This plan is presented in seven parts. Part One presents a sketch of the physical characteristics of the basin. Part Two reviews the present situation in each basin community, including size, population, water quality and a summary of pollution sources. Part Three discusses the potential for growth in the basin, based on population projections, and proposed land use patterns and transportation system configurations.

Part Four delineates and analyzes the river segment classifications established by the Department of Health, Division of Water Pollution Control. These river segments are ranked on the basis of abatement priority. This ranking is one of the factors considered in determining municipal sewerage facility priorities. Part Five details the actions recommended to meet municipal sewerage facility needs, and includes target abatement dates and estimated investment requirements. Part Six describes the water quality monitoring program carried on by the Rhode Island Department of Health. In the final part, the relationship of this plan to other elements of the State Guide Plan and to other related plans is outlined.

Acknowledgements

This plan was prepared in cooperation with the Rhode Island Department of Health, Division of Water Pollution Control, which is the state agency charged with the responsibility to control and abate sources of pollution. Major activities include: (1) review and approval of facilities plans, engineering reports and construction plans for municipal sewerage facilities; (2) review and approval of industrial pollution abatement plans; (3) allocation of state funds for municipal sewerage facilities planning and construction; (4) review and certification of National Pollutant Discharge Elimination System (NPDES) permits issued by the U.S. Environmental Protection Agency (EPA); and (5) monitoring of industrial and municipal treatment facilities operations, and surface and groundwater quality. This work is supported by state appropriations and by federal grants under the Federal Water Pollution Control Act Amendments of of 1972 (PL 92-500).

This basin plan was prepared by Mr. William B. Brinson, Research Technician, with the assistance of Mr. Thomas G. Brueckner, Senior Sanitary Engineer, and Mr. Victor J. Parmentier, Principal Planner, under the general supervision of Mr. Patrick J. Fingliss, Supervising Planner. Other Statewide Planning Program staff members involved in the preparation of this plan were: Ms. Janice Luther, Senior Clerk-Typist and Mr. Mansuet J. Giusti, Principal Engineering Aide.

Additional assistance was provided by Mr. Carleton A. Maine, Chief of the Division of Water Pollution Control, R.I. Department of Health and the Division staff, as well as by Mr. Juan Mariscal, Environmental Engineer, of the Areawide Waste Treatment Management Planning staff.

The preliminary draft of this plan was presented at a public meeting on June 10, 1976 at the Richmond Town Hall. Revisions have been made to the plan based on comments received at that meeting.

This plan was adopted as an element of the State Guide Plan by the State Planning Council on FEB 1 0 1977, following a public hearing on JAN 1 7 1977

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SUMMARY

The Pawcatuck River Basin, which drains nearly one-fourth of Rhode Island's land area, lies in the southwestern corner of the state. The total surface area of the basin is about 317 square miles, of which approximately 260 square miles are in Rhode Island and about 57 square miles are in Connecticut. The Rhode Island portion of the basin encompasses the towns of Exeter, Hopkinton, and Richmond and parts of the towns of Charlestown, North Kingstown, South Kingstown, Westerly, and West Greenwich. The basin also drains parts of four Connecticut communities: North Stonington, Sterling, Stonington, and Voluntown. All the basin communities are primarily rural with isolated centers of concentrated development, some of which is seasonal and shore-oriented.

All of the fresh water streams in the basin are of Class C or better and all tidal waters are of Class SC or better, as determined by the Rhode Island Department of Health. Five areas are out of compliance with their water quality classification: one reach of the White Horn Brook, one reach of the Wood River, and three reaches of the Pawcatuck main stem.

White Horn Brook: Degraded by University of Rhode Island sewage treatment plant and heating-boiler blowdown (cleaning) discharges, both scheduled for elimination, the first by March, 1977, the second by an unspecified date. (See page II-10.)

Wood River: Moderate degradation by inadequate individual sewage disposal systems in Hope Valley (Hopkinton). Abatement techniques and schedule not yet determined. (See page II-10.)

Pawcatuck River(upper): Degraded by Kenyon Piece Dye Works process water discharge (Charlestown), to be upgraded by November, 1976. (See page II-9.)

Pawcatuck River (middle): Degraded by New Bradford Dyeing Association process water discharge, (Westerly), to be upgraded by November, 1976; and by inadequate individual sewage disposal systems in Ashaway (Hopkinton), to be eliminated by sewer connection to the Westerly municipal system, at a date not yet determined. (See page II-9.)

Pawcatuck River (lower): Degraded by the Westerly municipal sewage treatment plant, to be upgraded by June, 1978; and by combined sewer and industrial discharges in Pawcatuck, Conn., scheduled for elimination sometime in 1978. (See page II-8 and 9.)

All surface waters in the basin are expected to be in compliance with their classifications by 1978, with the exception of the middle reach of the Pawcatuck River, which is degraded by the Ashaway discharges; and the lower Wood River, which is degraded by the Hope Valley discharges. Abatement dates for these discharges have not been determined. (See pages IV-13 through IV-20.)

Basin streams are divided into 37 "segments" for the purpose of this plan. These segments are discussed in detail herein, as are seventeen identified point-source discharges, three of which consist only of non-contact cooling water. (See pages IV-2 through IV-13.)

The two largest discharges in the basin are:

(1) the University of Rhode Island secondary treatment plant discharge to the White Horn Brook (0.6 million gallons per day), scheduled for elimination by mid-1977, and

(2) the Westerly municipal primary treatment plant (1.05 million gallons per day), scheduled for upgrading to secondary treatment by June, 1978.

Actions leading to improved surface water quality are summarized below (See Part V):

<u>Municipal facilities currently under construction</u>

(1) Westerly: Upgraded treatment plant from primary to secondary treatment. New interceptor and collector sewers for expanded service area. (To be completed June, 1978.)

(2) South Kingstown (Narragansett) Regional System: New Secondary treatment plant. (To be completed September, 1976.) New interceptor and collector sewers for expanded service areas (both towns). (To be completed March, 1977.)

<u>Municipal facilities programmed</u>

(1) Stonington, Connecticut: New secondary treatment plant. New interceptor and collector sewers to replace combined sewer system and for expanded service area. (Approved by EPA, December, 1975; construction delayed by ligiation, completion expected two years after start of construction, probably complete in 1978.)

(2) Westerly: New interceptor and collector sewers to replace individual sewage disposal systems in the Watch Hill area, with treatment at Westerly municipal plant. (Timing contingent upon state and local funding.)

(3) Hopkinton: New interceptor and collector sewers in Ashaway Village to replace individual sewage disposal systems; tie-in to Westerly system. (Tentative; design, cost, and timing not yet established.)

Municipal facilities needs to be determined under Section 208 areawide planning program

(1) Hopkinton and Richmond: Solutions for abatement of pollution from inadequate individual sewage disposal systems in the Hope Valley-Wyoming area (Hopkinton-Richmond).

(2) North Kingstown: Determination of need for and time frame of public sewer service to Saunderstown Village, with consideration for waste treatment by the South Kingstown regional treatment plant.

(3) South Kingstown: Determination of need for and time frame of public sewer service to West Kingston Village, with consideration for impact on South Kingstown regional system currently under construction.

Industrial and other treatment improvements programmed

(1) Kenyon Piece Dye Works (Richmond): Treatment to be upgraded by November, 1976.

(2) Charbert, Inc. (Richmond): Discharge to be eliminated by December, 1976. (Construction currently under way.)

(3) New Bradford Dyeing Association (Westerly): Treatment to be upgraded by November, 1976.

(4) Yardney Electric Corporation and Harris Intertype Corporation, Cottrell Division (Stonington, Connecticut): Partial tie-in to new Stonington municipal system, remainder pre-treated before discharge to Pawcatuck River.

(5) University of Rhode Island: Elimination of boiler blowdown discharge through in-ground disposal. (Timetable unavailable.)

PART ONE: BASIN DESCRIPTION

The Pawcatuck River Basin, the largest in Rhode Island, lies in the southwestern corner of the state, as Figure 1 illustrates. The basin also extends into two small portions of Connecticut: one along the Pawcatuck River main stem at its outlet into Block Island Sound, where the river forms the state boundary; and another, smaller portion of eastern Connecticut, which is tributary to the Falls River, a headwater stream. Figure 2 illustrates both the natural hydrologic boundary of the basin in both Rhode Island and Connecticut and the adjusted boundary established in Rhode Island for study purposes. The total surface area of the hydrologic basin is about 317 square miles, of which approximately 260 square miles are in Rhode Island, and about 57 square miles in Connecticut.

The basin encompasses all or part of twelve communities, also shown on Figure 2. Those included in the Rhode Island portion of the basin are:

Charlestown(part)
Exeter
Hopkinton
North Kingstown(part)
Richmond
South Kingstown (part)
Westerly(part)
West Greenwich (part)

and in Connecticut:

North Stonington (part)
Sterling (part)
Stonington (part)
Voluntown (part)

All of these communities are primarily rural with isolated centers of population concentration and/or shore-oriented development.

The basin, which drains nearly one-fourth of Rhode Island's land area, is over 25 miles long and nearly 24 miles wide at its widest point. The middle and upper regions of the basin are of a gently rolling landform interspersed with many wetlands and ponds. The main stem of the Pawcatuck River rises in the extreme eastern end of the basin at Worden Pond. It falls 90 feet in its meandering 33 mile-long course, flowing southwesterly through the rural Richmond-Charlestown countryside, and then southerly through the only urban concentration in the basin - the Westerly-Pawcatuck area.

FIGURE 1

LOCATION MAP

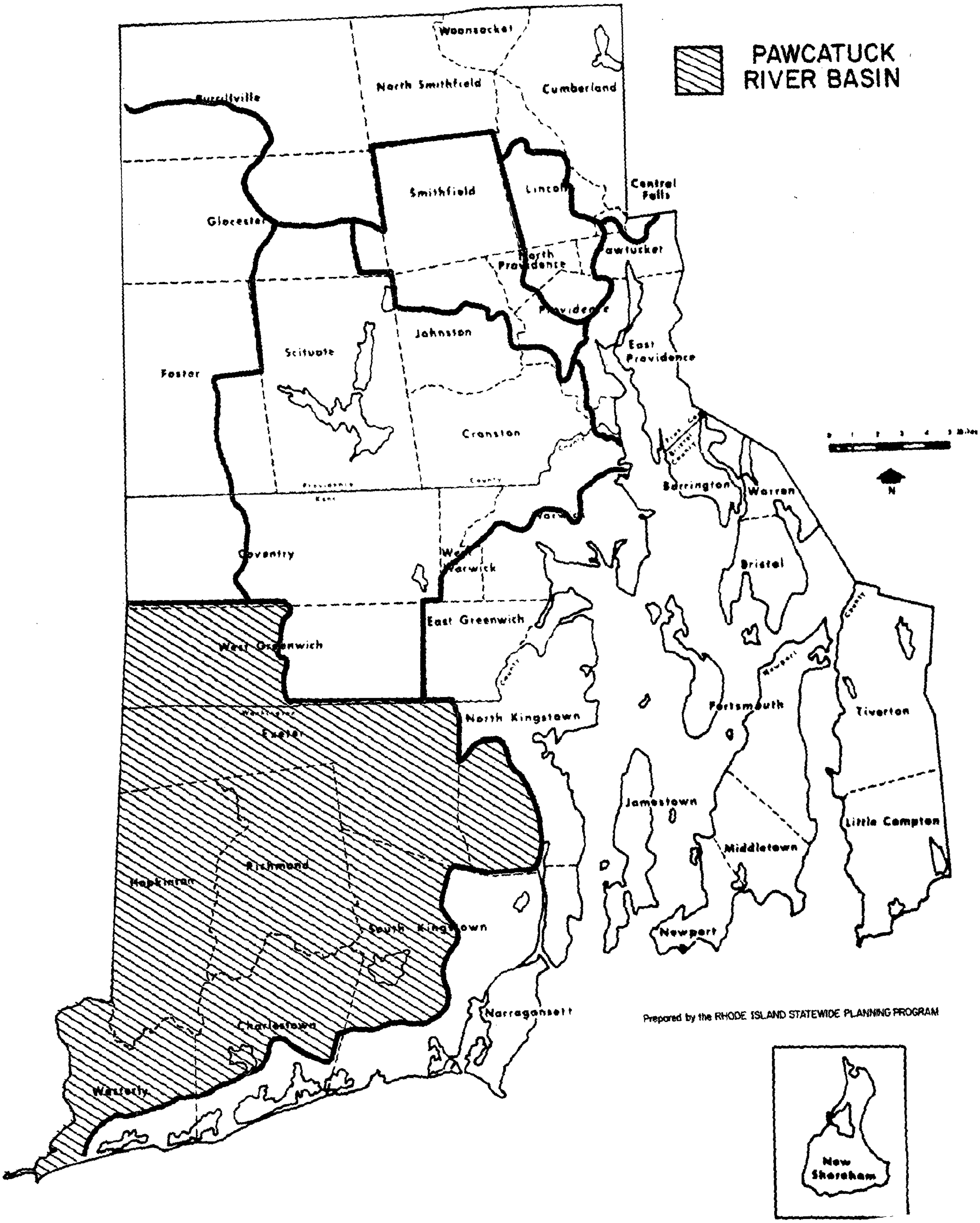
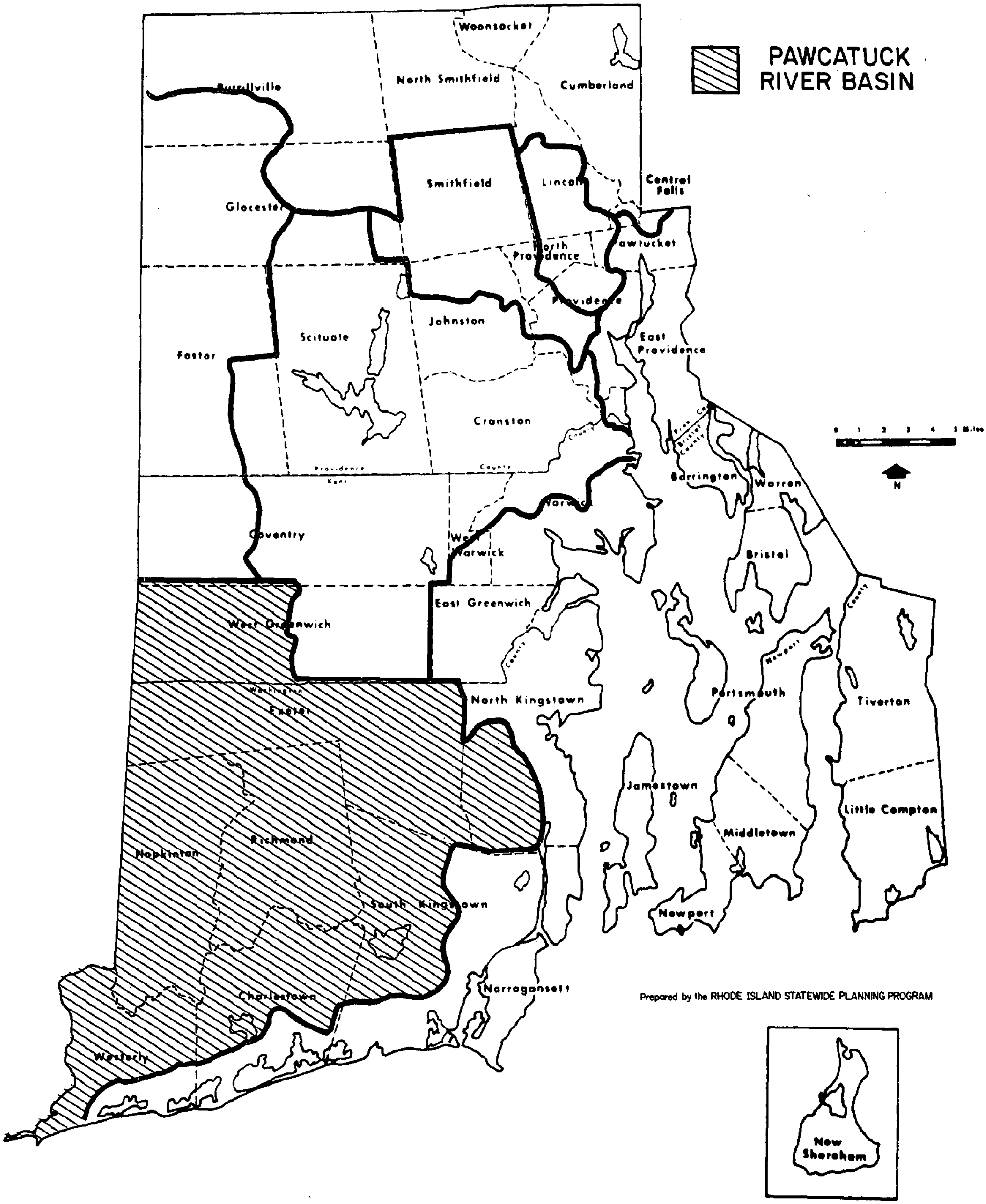


FIGURE 1

LOCATION MAP



STATE PARKS, FORESTS, ETC.
MAJOR SAND AND GRAVEL AQUIFER
PROPOSED RESERVOIR SITE
AREAS OF DEVELOPMENT
PUBLIC WATER SUPPLY WELL SITE

FIGURE 2

GENERAL BASIN CHARACTERISTICS

PAWCATUCK RIVER BASIN
RHODE ISLAND

BASIN PLANNING BOUNDARY
BASIN HYDROLOGIC BOUNDARY

0 6000 12000 18000 24000 30000
SCALE IN FEET

N

Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM

The final five-mile reach of the river is tidal from Westerly to its mouth at Rhodes Point, where it enters Little Narragansett Bay and emerges into Block Island Sound. En route to the ocean, the river receives flows from over 60 tributaries with a total length of about 250 miles. The three major tributaries are the Usquepaug, the Wood and the Ashaway Rivers, all of which enter from the north.

The Usquepaug River, with a drainage area of 44 square miles, accounting for about 15 percent of the Pawcatuck drainage area, rises in Glen Rock Reservoir in the northwest corner of South Kingstown and proceeds in a general southerly direction through open countryside for nearly 5 miles to its confluence with the Pawcatuck River in Great Swamp about 1.5 miles below the outlet of Worden Pond. Queen's River is the principal headwater tributary of the Usquepaug River. It rises in the southeastern corner of West Greenwich, Rhode Island in Bear Swamp and flows 9 miles in a southwesterly direction through Locke Swamp to Glen Rock Reservoir.

The Wood River with a drainage area of 87 square miles, accounting for 29 percent of the basin drainage area, is formed by the confluence of Phillips and Acid Factory Brooks in the southwestern part of West Greenwich. It flows a total distance of 17 miles through Beach Pond Reservation, Arcadia Reservation and then through the more heavily populated area of Hope Valley in Hopkinton, Rhode Island. Beyond Hope Valley, it continues south through very sparsely settled countryside until it joins the Pawcatuck, thereby forming the boundaries among the Rhode Island towns of Hopkinton, Richmond and Charlestown, about 22 miles upstream from the mouth of the Pawcatuck.

The Ashaway River, with a drainage area of 50 square miles, accounting for 17 percent of the basin drainage area, is formed by the confluence of the Green Fall River and Parmenter Brook in the western part of Hopkinton. It flows southward for 3 miles, passing through the village of Ashaway in Hopkinton. It joins the main stem of the Pawcatuck at the juncture of the towns of Hopkinton, Westerly and the Connecticut community of North Stonington, about 10 miles upstream from the mouth of the Pawcatuck. ((44:42))

Drainage through the basin's gently sloping terrain is relatively slow, and often interrupted by swamps, marshes and ponds. The 63 bodies of open, fresh water in the basin, many of them manmade, have a total surface area of 3,635 acres, including the 1,036-acre Worden Pond, largest natural pond in the state. ((36:7)) The hundreds of wetlands which dot the terrain cover more than 10,000 acres.

About ten percent of the approximately 171,000 acres of land in the planning area has been committed to recreation and conservation uses. Most of this undeveloped land is included in the eleven state parks and management areas in the basin. Based on a study of 1970 land use ((6)), an estimated eight percent of the planning area is devoted to urban land uses, including highways. The remaining 82 percent is open or woodland, primarily in private ownership. Approximately 11,000 of these 140,000 remaining open/woodland acres are estimated to be undeveloped wetland or steep landforms ((9B)), leaving (in 1970) approximately 129,000 open acres which are suitable for development in terms of these two factors.

The State Land Use Policies and Plan proposes that approximately 37,000 acres (22 percent of the planning area) be committed to recreation and conservation uses by 1990. ((32:132)) Included in this proposed figure would be 2,000 acres of streambank along the Pawcatuck, Wood, Beaver, Queen's and Chipuxet Rivers, identified in the Rhode Island Audubon Society's survey of unique and significant natural areas as "...the only remaining major (river) system in Rhode Island that is pristine, has great stretches of wilderness shoreline, and is virtually pollution free." ((2: Area Number 53))

Extensive deposits of glacial outwash (stratified deposits of unconsolidated gravel, sand, silt and clay) fill depressions in the underlying bedrock and till throughout the basin. These deposits lie primarily along river valleys. They retain large amounts of groundwater for short periods of time and then discharge it to their associated streams. The U.S. Geological Survey and the Rhode Island Water Resources Board have jointly identified those stratified deposits of gravel and sand which have potential as significant sources of water supply for public drinking, industry and irrigation. ((1, 5)) The general locations of these major gravel and sand aquifers are shown on Figure 2.

There are five streamflow gaging stations maintained by the U.S. Geological Survey in the Pawcatuck River Basin in Rhode Island. The locations of these gaging stations and selected data from them are includedin Figure B-1 and Table B-1 in Appendix B.

PART TWO: EXISTING CONDITIONS

A. General

All of the eight communities in the Pawcatuck Basin are primarily rural in character. Public sewer and water supply service are available only in limited areas of concentrated population, the most significant of which are the central business districts of Westerly and Pawcatuck, Connecticut and the University of Rhode Island area in Kingston (See Figure 2). With these exceptions, the entire basin depends on individual, subsurface sewage disposal systems and individual wells. Current public and private water supplies in the basin are dependent solely upon wells which draw upon groundwater reservoirs in the basin. The major public water supply well sites and aquifers are delineated on Figure 2.

According to Rhode Island Department of Health records, basin-wide usage of groundwater approached six million gallons per day in 1973, with the Westerly Water Department, the Wakefield Water Company, and the University of Rhode Island extracting most of this total. The Westerly Water Department supplies downtown Westerly, the village of Bradford, and Pawcatuck Borough in Stonington, Connecticut. The Wakefield Water Company serves the Wakefield-Peacedale area of South Kingstown, which is in the Narragansett Bay Basin.

The following section presents profiles of the eight communities in the planning area, as well as brief sketches of existing conditions in the Connecticut portion of the Pawcatuck Basin. Table 1 summarizes selected demographic data for the Rhode Island communities in the basin.

B. Community Profiles

1. Town of Charlestown

Approximately 75 percent (31.68 square miles) of the land area of this town lies within the Pawcatuck Basin planning area. The remainder drains to Block Island Sound through minor coastal streams. This coastal area is discussed in the Narragansett Bay Basin Water Quality Management Plan.

According to the U.S. Census, year-round population residing in the Pawcatuck Basin portion of the town in 1970 was approximately 1,574, or about 64 percent of the town's total year-round population. This very low-density (0.08 persons per acre) year-round population ((33)) is approximately one-half of the summer population as a result of the predominantly shore-oriented character of the community. The town contains a correspondingly large proportion of seasonal housing units (approximately 49 percent of all housing units were seasonal in 1970, on a town-wide basis). ((32:79)) The entire town is served by on-site sewage disposal and water supply systems.

TABLE 1

Selected Demographic Data (1970)

Pawcatuck River Basin Communities, Rhode Island ((33))

Municipality	Population	Total area (acres) (square miles)	Gross Density (persons/acre)	Dwelling Units (DU's)	Percent of DU's Occupied	Persons Per DU ((32:91))
Charlestown (part)	1,574	20,278 31.68	0.08	600	80.5	3.1
Exeter	3,245	36,640 57.25	0.09	795	88.5	3.3*
Hopkinton	5,392	28,082 43.88	0.19	1,693	93.6	3.4
North Kingstown (part)	1,157	7,085 11.07	0.16	391	88.2	3.1
Richmond	2,625	24,965 39.01	0.10	830	90.5	3.5
South Kingstown (part)	7,510	20,580 32.16	0.36	1,284	74.7	3.1*
Westerly (part)	16,256	16,528 25.83	0.98	5,476	92.0	3.2
West Greenwich (part)	501	20,521 32.06	0.02	207	75.4	3.3
Planning Area Total	37,859	174,679 272.94	0.22	11,276	88.9	3.3

* Excludes population in group quarters.

2. Town of Exeter

This community is entirely within the Pawcatuck River Basin. The town is rural in character, with large state-owned recreation and management areas in the western part (See Figure 2 in Part One). The state-operated Dr. Joseph H. Ladd School for retarded children and adults occupies about 560 acres in the eastern part of town. The 1970 census indicated a total population of 3,245 within a total surface area of 57.25 square miles (0.09 persons per acre). ((33)) At the present time, the entire community is served by on-site sewage disposal systems and water supplies.

3. Town of Hopkinton

With the exception of the villages of Ashaway and Hope Valley, this community, which is completely within the study area, is rural in character. The 1970 census indicated that the town's population totaled 5,392, with 1,675 in Ashaway and 1,326 in Hope Valley. The total surface area of the town is 43.88 square miles. ((33)) There is no public sewer system in Hopkinton at the present time.

Locally poor soil conditions, bedrock outcrops and inadequate individual disposal systems require that consideration be given to providing sewer service to the Ashaway and Hope Valley areas in order to improve and maintain water quality in the Ashaway and Wood Rivers, and associated groundwater reservoirs.

4. Town of North Kingstown

That portion (26 percent) of this community which is within the Pawcatuck River Basin is rural in character and totally dependent on on-site sewage disposal facilities. Public water is provided to the Slocum area as part of the North Kingstown municipal system. The Slocum area contains some of the finest agricultural land in the state. ((32:50))

In 1970, 1,157 persons or 4 percent of the town's residents were located on the 11.07 square miles within the basin (0.19 persons per acre). ((33)) They are reliant solely upon on-site sewage disposal systems.

5. Town of Richmond

This community encompasses an area of 39.01 square miles with a population of 2,625 (0.10 persons per acre). ((33)) The town is completely within the Pawcatuck Basin, and is predominantly rural in character, with areas of concentrated development in the Wyoming-Hope Valley, Shannock-Kenyon and Alton-Wood River Junction areas. There is no public water or sewer service in the community.

6. Town of South Kingstown

Approximately 54 percent of this town's area (32.16 square miles) lies within the Pawcatuck Basin planning area, with the remaining 46 percent in the Narragansett Bay Basin. The 1970 population of the area was 7,510, at a gross density of 0.36 persons per acre. There are no public sewerage systems in the town. However, the University of Rhode Island (URI), in Kingston, operates its own sewage collection system and treatment plant (See Figure 3). The URI-Kingston area is the only area of concentrated population within the Pawcatuck Basin portion of South Kingstown. The Wakefield-Peacedale area of South Kingstown, which lies in the Narragansett Bay portion of the town, is discussed in the plan for that basin.

Engineering design has been completed for an interceptor sewer which will connect the Kingston-URI area and the Wakefield-Peacedale area to the South Kingstown regional treatment plant currently under construction in the town of Narragansett (See Figure 3). This facility will also serve Bonnet Shores, URI's Bay Campus, and the Mettatuxet section of Narragansett's north end, as well as the Narragansett Pier section, where the new treatment plant is located. The treatment plant is expected to go into service in late 1976. The Kingston-Wakefield-Peacedale interceptor should be in service by March, 1977. ((15))

7. Town of Westerly

The town of Westerly includes part of the only densely developed urban area in the Pawcatuck Basin - the Westerly-Pawcatuck area, which sits astride the Rhode Island-Connecticut state line near the mouth of the Pawcatuck River (See Figure 2 in Part One). The remainder of the town is primarily rural with concentrations of seasonal development along the coast. Approximately 25.8 square miles (85 percent) of the town lies within the planning area. In 1970, the population in the Westerly portion of the basin was 16,256 (94 percent of the town total). The average gross density for the Pawcatuck Basin portion of the town was 0.98 persons per acre, while in Westerly Center it was about 5 persons per acre.((33)) The remaining area of the town (along the shore of Block Island Sound) lies in the Narragansett Bay Basin.

The water supply needs of the urban area which encompasses portions of the towns of Westerly, Rhode Island and Stonington, Connecticut are served by the Westerly Water Department, which also serves the village of Bradford. The public water supply, which is derived solely from pumped wells, appears to be adequate for anticipated growth over the study period. Present supplies of electrical power appear adequate for the near future, but may require additional capacity if significant intensive development occurs. ((34:5-10))

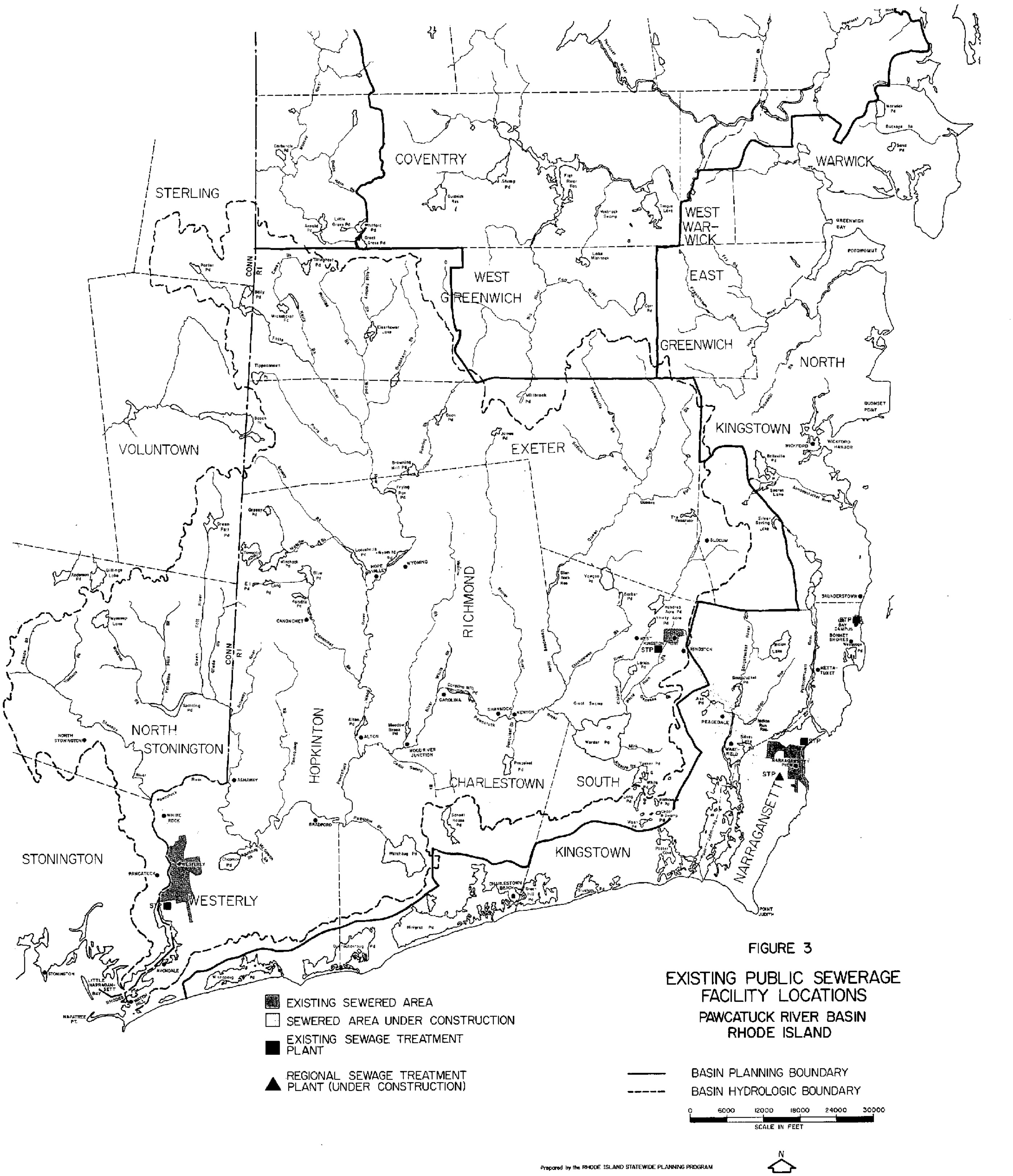


FIGURE 3

EXISTING PUBLIC SEWERAGE FACILITY LOCATIONS

PAWCATUCK RIVER BASIN
RHODE ISLAND

The existing Westerly sewerage system, which includes approximately 35 miles of gravity sewer pipes and force mains, served about 10,000 people in 1974. This system was originally installed in the 1920's and serves the downtown area. It is a sanitary system only, which admits no stormwater intentionally, but did have severe groundwater infiltration problems until 1972, when repairs to a main trunk sewer reduced infiltration flows by about half. Programmed repairs are expected to reduce infiltration flows even further. This system is currently being upgraded and expanded.

The existing treatment plant was built in 1957, with a design daily capacity of approximately two million gallons. It provides primary treatment and disinfection for the sewage influent. The primary treated sewage is discharged into the Pawcatuck River estuary 110 feet from shore through a single outfall sewer located near Major Island (See Figure 3). The digested sludge produced by the plant is dried and used as landfill at the treatment plant site. The plant removes approximately 25 percent of the biochemical oxygen demand and 60 percent of the suspended solids from the influent. These levels of removal are not adequate to meet federal regulations. ((7: 1-6)) An upgraded treatment plant has been designed and has received EPA approval.

In addition to the area served by the municipal sewerage system, several homes in the village of Bradford discharge sewage to the nearby New Bradford Dyeing Association lagoon which, in turn, discharges to the Pawcatuck River. ((15)) The remainder of the town of Westerly depends on individual subsurface sewage disposal systems.

8. Town of West Greenwich

Approximately 22.8 square miles or 45 percent of the town's total area is within the Pawcatuck River Basin. In 1970, a total of 501 people, 27 percent of the town's total population, resided within the basin (0.02 persons per acre). There is no public water or sewer service to the Pawcatuck Basin portion of the town.

The site of the proposed Big River Reservoir is located in the eastern portion of this community, and lies in the Pawtuxet River Basin (See Figure 2). This site will encompass 11 square miles or 22 percent of the town's total land area. The Big River Reservoir project is discussed in greater detail in the Pawtuxet River Basin Plan. Under present plans no areas of the Pawcatuck River Basin will be served by this water supply facility.

9. Connecticut Communities

The approximately 57 square mile area of the basin which lies in Connecticut is divided into two portions (See Figure 2 in Part One). The northern part encompasses approximately ten square miles in the towns of Sterling and Voluntown. There is no significant population in this area, as most of it is under state management as part of the Pachaug State Forest, where the Wood River begins. The streams here are of high quality, and are likely to remain so, since there is minimal exposure to degrading influences in the state forest.

The major portion of the Pawcatuck Basin in Connecticut lies along the state line in the towns of Voluntown, North Stonington and Stonington. The northern extremities of this portion of the basin (Voluntown and North Stonington) also lie within the Pachaug State Forest and are very sparsely settled.

a. Town of North Stonington

Approximately 40 square miles (70 percent) of the town of North Stonington are tributary to the Pawcatuck River, principally through the Green Fall and Shunock Rivers. In 1970, approximately 3,400 people lived in the Pawcatuck Basin portion of the town. Most of this population is concentrated in the Borough of North Stonington, which is under considerable residential development pressure.

b. Town of Stonington

Nearly 16,000 people live in the town of Stonington, with about one-third of this population (5,255 according to the 1970 census) concentrated in the Borough of Pawcatuck, immediately across the Pawcatuck River from downtown Westerly. Population concentrations and the condition of the combined storm and sanitary and individual sewage disposal systems in the borough require that a public sewage collection and treatment system be installed. At present there are only combined storm and sanitary sewerage facilities in the Connecticut portion of the basin.((3: 1-3))

In 1974, the U.S. Environmental Protection Agency, in concurrence with the Connecticut Department of Environmental Protection and the towns of Stonington and Westerly, determined that separate sewage treatment plants should be constructed for Westerly and Pawcatuck. This solution appeared to be the most expeditious in light of the fact that bond issues for construction of separate facilities had, at that time, already been approved by the voters, and some design work had been done. Construction of an interstate facility to serve both Westerly and Pawcatuck would have required negotiation of an interstate agreement and voter approval of new bond issues, resulting in an estimated delay of at least one year in proceeding with the design phase.

The above material on Connecticut communities was prepared with the assistance of the Southeastern Connecticut Regional Planning Agency in Norwich and the Connecticut Department of Environmental Protection's Interim Basin Plan for the Eastern Connecticut Coastal Basin (Pawcatuck). ((3))

C. Water Quality

All the waters of the state have been classified by the Rhode Island Department of Health according to their use or water quality. Standards associated with the classifications are defined by nine water quality parameters. The most important of these parameters is dissolved oxygen, since the survival of aquatic life and the stream's assimilative capacity are dependent on dissolved oxygen concentration. The Standards of Quality for Classification of Waters of the State are given in Appendix A.

A water quality survey was undertaken in August of 1973 by the Division of Water Pollution Control of the Rhode Island Department of Health. Figure B-1 and Table B-2 in Appendix B present the sampling station locations and data for the 1973 survey. The dissolved oxygen levels noted at sampling stations 2, 3, 4 and 5 fell below the 5.0 milligrams per liter (mg/l) minimum required of Class C waters. Substandard water quality at these locations was the result of discharges from the New Bradford Dyeing Association, the Collins and Aikman Company, and the Ashaway Line and Twine Company. Since this survey was conducted, the Collins and Aikman and Ashaway Line and Twine firms have eliminated their discharges. The Bradford Dyeing Association has drastically curtailed its manufacturing activities, thus reducing the volume of its discharge and its consequent impact on the Pawcatuck River. All streams in the basin are now assumed to be in compliance with Class C (SC if tidal) standards. However, four river reaches in the basin are out of compliance with their B (SB) classifications and one is out of compliance with its SA classification, as a result of the types and amounts of pollutants being discharged from certain sources. These reaches are discussed in detail below. Their locations, as well as the water quality classification for each stream in the basin, are indicated on Figure 4.

1. Little Narragansett Bay

Approximately 770 acres of Little Narragansett Bay between Napatree Point and the mouth of the Pawcatuck River at Rhodes Point are currently out of compliance with the SA classification, and are closed to shellfishing. Total coliform bacteria counts (See Appendix

B) at sampling station 1, about two miles upstream, were well above both Class SB and SA limits. Water quality degradation in this area is the result of the combined effects of discharges from combined storm and sanitary sewers in Pawcatuck and from industrial and municipal sources along the lower main stem.

2. Pawcatuck River Estuary

The Pawcatuck River is tidal from its mouth at Rhodes Point to the Old Stillmanville Dam at Main Street in Westerly. Approximately 260 acres at the lower end of the estuary do not meet the assigned SB classification, although there are no discharges to this segment. Data from sampling station 1 indicates total coliform counts in excess of the Class SB maximum (see Appendix B). Water quality here is affected by discharges into upstream segments. These discharges include Westerly's primary treatment plant and industrial and combined sewer dischages in Pawcatuck, Connecticut.

3. Pawcatuck River

Nearly five and one-half miles of the lower main stem of the Pawcatuck between the Bridge Street crossing in the White Rock section of Westerly and the R.I. Route 3 crossing are out of compliance with the assigned B classification. As mentioned earlier in this section, the New Bradford Dyeing Association, the Collins and Aikman Company and the Ashaway Line and Twine Company have eliminated or reduced their discharges sufficiently to allow the river to attain its present Class C condition. Dissolved oxygen concentrations at sampling stations 3 and 4 were below Class C minimums in 1973, but are assumed to have improved with recent reductions in pollutional loading. Discharges from the New Bradford Dyeing Association operations and from individual sewerage systems in the village of Ashaway in Hopkinton prevent this reach from attaining the Class B standards.

An additional two and one-half mile stretch of the Pawcatuck main stem fails to meet Class B standards. This stretch extends downstream from the head of the Carolina Mill Pond (upstream of Carolina Village) about halfway to the Meadow Brook confluence. Total coliform counts at sampling station 10 were above Class B limits. The segment fails to meet the Class B standard because of the type and level of pollutional loading placed upon the main stem by the Kenyon Piece Dye Works discharge at Kenyon Village.

4. White Horn Brook

A two-mile reach of the White Horn Brook below the University of Rhode Island fails to meet the assigned Class B usage standard as a result of the boiler blowdown and treatment plant effluent discharged by the University.

5. Wood River

Approximately 2.4 miles of the Wood River, between Hope Valley and the Canonchet Brook confluence, do not comply with the assigned B classification, because of individual sanitary system discharges in Hope Valley, which are incompatible with Class B uses. ((15))

D. Point Source Discharges

Fourteen discharges in the Pawcatuck Basin planning area have been identified by the Rhode Island Department of Health, Division of Water Pollution Control, and three by the Connecticut Department of Environmental Protection. Table 2 identifies the dischargers, receiving waters, locations (river mile and town) and types of waste. The table also includes the severity of pollution ranking of each Rhode Island discharge. The severity of pollution ranking is a ranking among all point source discharges in the planning area according to the strength and/or toxicity of the wastewater discharge. The discharge with the greatest strength and/or toxicity has a ranking of 1, the second greatest, a ranking of 2, and so forth. The locations of the discharges are shown on Figure 4. Table 3 summarizes data on each discharge for several parameters. These data are the result of a cooperative monitoring program carried on by the Division of Water Pollution Control and the individual dischargers. The sampling or permit date is given in parentheses under the discharger's name.

The following descriptions of these discharges are based on R.I. Department of Health records and on National Pollutant Discharge Elimination System (NPDES) permit information provided by the U.S. Environmental Protection Agency (EPA). The number in parentheses is the severity of pollution ranking for the discharge.

P1: (7) The Joseph H. Ladd School, Exeter, operates a secondary sewage treatment plant which discharges into the Queen's River, a Class C river in this area. The treatment process consists of primary sedimentation, a one-stage trickling filter, and chlorination. ((15))

TABLE 2

Descriptions of Point Source Discharges

Pawcatuck River Basin

Discharge Number	Receiving Water	River Mile	Name of Discharger	Location	Type of Waste	Severity of Pollution Ranking
P1	Queen's River	30.7+9.7	Joseph J. Ladd School	Exeter	Sanitary	7
P2	White Horn Brook	32.0+4.7	University of Rhode Island	Kingston	Boiler blowdown	10
P3	White Horn Brook	32.0+4.7	University of Rhode Island	Kingston	Sanitary	2
P4	Pawcatuck River	29.4	Kenyon Piece Dye Works	Kenyon	Textile	3
P5	White Brook	26.1+1.6	American Fish Culture, Inc.	Richmond	Process	11
P6	Pawcatuck River	23.9	United Nuclear Corp.	Charlestown	Cooling	12
P7	Wood River	21.6+0.6	Charbert, Inc.	Alton	Textile	4
P8	Canonchet Brook	21.6+3.3+ 2.8	Green Plastics Corp.	Canonchet	Cooling	13
P9	Wood River	21.6+(6.4to 7.6)	Individual sewers	Hope Valley	Sanitary	6
P10	Brushy Brook	21.6+6.6+ 0.2	Auralux Chemical Corp.	Hope Valley	Cooling	14
P11	Pawcatuck River	16.0	New Bradford Dyeing Assoc.	Bradford	Textile	5
P12	Ashaway River	9.9+(0.0 to 0.75)	Individual sewers	Ashaway	Sanitary	8
P13	Pawcatuck River	3.4	Westerly sewage treatment plant	Westerly	Municipal	1
P14	Little Narragansett Bay	Below mouth	Individual sewers	Watch Hill	Sanitary	9
P15	Pawcatuck River	4.4 to 6.3	Individual sewers	Pawcatuck (Conn.)	Sanitary	-
P16	Pawcatuck River	4.4	Yardney Electric Corp.	Pawcatuck (Conn.)	Industrial	-
P17	Pawcatuck River	4.2	Harris Intertype Corp. Cottrell Division	Pawcatuck (Conn.)	Industrial	-

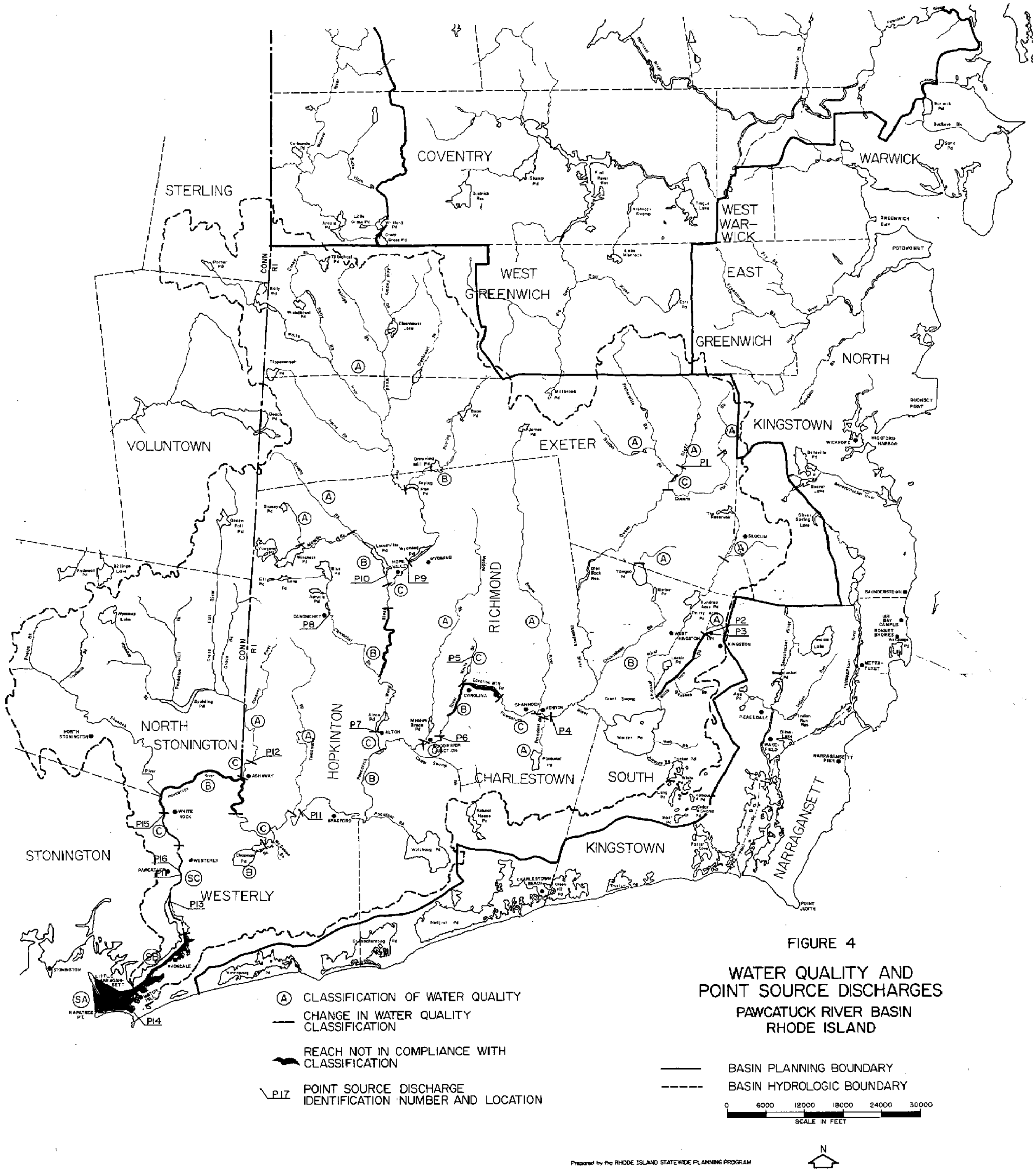


FIGURE 4

WATER QUALITY AND POINT SOURCE DISCHARGES
PAWCATUCK RIVER BASIN
RHODE ISLAND

TABLE 3

Point Source Discharge Data

Pawcatuck River Basin

Discharge Number	Name of Discharger (date of sample)	Flow* (mgd)	Temp (°F)	BOD_5 (mg/1)	Suspended Solids (mg/1)	Coliform (MPN/100ml) Total	Fecal	pH	Other**	Data Source
P1	Ladd School (4/17/75)	0.075	-	17	32	230×10^3	23×10^3	7.0	detergent MBAS = 0.7	A
P2	URI - Boiler blowdown	NO DATA AVAILABLE, NPDES PERMIT APPLICATION PENDING WITH EPA								
P3	URI - Treatment plant (5/15/75)	1.0	-	11	20	2.3×10^6	2.3×10^3	7.0	detergent MBAS = 0.4 turbidity(JTU) = 15	A
P4	Kenyon Piece Dye Works(5/12/76)	0.557	68	38	104	2.4×10^6	2.4×10^4	7.3	detergent MBAS = 0.48 color=500 standards units	A
P5	American Fish Culture, Inc.	NO DATA AVAILABLE								
P6	United Nuclear Corp. (4/14/75)	0.031	70	-	-	-	-	7.4	alpha radiation = 3.4×10^{-8} microcuries/ml beta/gamma radiation = 2.0×10^{-8} microcuries/ml	B
P7	Charbert, Inc. (7/10/75-1/10/76) (averages)	0.023	70	201	162	-	-	6.8	detergent MBAS = 0.1, sulfide = 0.375, iron = 2.3, phenol = 0.05	B
P8	Green Plastics Corp.(10/1/74)	0.021 0.122	69 68	- -	- -	- -	- -	- -		
P9	Hope Valley - Individual sewers	NO DATA AVAILABLE								
P10	Auralux Chemical Corp. (6/30/74)	0.0033	70	-	-	-	-	5.9		B
P11	New Bradford Dyeing Assoc.	NO DATA AVAILABLE, OPERATIONS TEMPORARILY HALTED								
P12	Ashaway - Individual sewers	NO DATA AVAILABLE								
P13	Westerly Municipal Sewage Treatment Plant (4/22/75)	1.3	-	157	108	230×10^3	0	6.6	turbidity (JTU) = 85	A
P14	Watch Hill - Individual sewers	NO DATA AVAILABLE								
P15	Pawcatuck - Individual sewers	NO DATA AVAILABLE								
P16	Yardney Electric Corp. (3/31/75)	0.183	4° rise in receiv. water	200	200	-	-	6.0 to 9.0	In Kg/day: Zn = 2.7, AL = 0.2, NH_3-N=5.68, Iron = .02, Tin = .002, Silver = .05, Total Cr= .01, Nickel = .01, Cu = 0.2, Mercury = 24×10^{-9}, hexav.Cr.=.008	C
P17	Cottrell Division - Harris Inter-type Corp. (8/26/74)	0.0175	85	200	200	-	-	-	Includes sanitary wastes, cooling water and boiler blowdown	C

Data Sources: A. Rhode Island Department of Health, B. Discharger, C. NPDES Permit Discharge Limits
*** Instantaneous rate of flow during sampling**
** In mg/1 unless otherwise noted

P2: (10) The University of Rhode Island in Kingston has a boiler blowdown discharge which results from cleaning of the heating system boilers. This intermittent, low-volume discharge to the Class B White Horn Brook may be high in phosphates or other chemicals which are used as corrosion inhibitors. ((15))

P3: (2) The University of Rhode Island also discharges effluent from its 1.2 million-gallon per day (MGD) secondary sewage treatment plant to the White Horn Brook. Flows at the treatment facility are approaching design capacity and the brook cannot accept additional pollutant loading. The facility will be taken out of service by March, 1977, when URI will tie into the new South Kingstown sewerage system, currently under construction.((15))

P4: (3) The Kenyon Piece Dye Works, Charlestown, is a textile finishing firm which discharges treated process wastewater from an aerated lagoon into the Pawcatuck River. The river is classified C in this area. Upgraded treatment, including an additional aerated lagoon, a settling pond and possible chlorination is programmed for late 1976. ((15))

P5: (11) American Fish Culture, Inc., a fish hatchery in Richmond, discharges from a series of settling ponds to White Brook, a tributary of the Pawcatuck River. White Brook is a Class C stream. ((15))

P6: (12) United Nuclear Corporation, a materials recovery operation in Charlestown, discharges non-contact cooling water to the Pawcatuck River, which is classified C in this area. ((15))

P7: (4) Charbert, Inc., a textile finishing firm in Alton Village, Richmond, discharges processing waste from an aerated lagoon to the Wood River, which is Class C in this area. The Rhode Island Department of Health has reviewed construction plans for a series of seepage pits which are expected to eliminate this discharge by December, 1976.((15))

P8: (13) Greene Plastics Corp., Canonchet, Hopkinton, discharges non-contact cooling water to the Canonchet Brook, a Class B tributary of the Wood River. ((15))

P9: (6) Due to locally poor soil conditions and bedrock outcrops, inadequate individual domestic and commercial sewerage systems in Hope Valley discharge raw sewage and leachates into this Class C segment of the Wood River. Determination of the extent and severity of these discharges, and of alternative methods of abatement will be considered under the areawide (208) planning process. ((23:23))

P10: (14) Auralux Chemical Corporation, Hope Valley, Hopkinton, discharges non-contact cooling water into Locustville Pond on the Class B Brushy Brook, which is a tributary of the Wood River. ((15))

P11: (5) The New Bradford Dyeing Association discharges textile process water to a lagoon, which in turn discharges to the Pawcatuck River, which is Class C in this area. Several nearby homes also discharge domestic wastes to the lagoon. Treatment of the process water will be upgraded by November, 1976, by the addition of a neutralization pond. ((15))

P12: (8) Inadequate individual sewage disposal systems in Ashaway Village, Hopkinton, discharge raw sewage and leachates into the Ashaway River, which is classified C near the village. Ashaway is tentatively programmed for a system of interceptor and collector sewers to be tied into the Westerly municipal sewer system. No schedule has been established. ((15))

P13: (1) The Westerly sewage treatment plant discharges primary effluent into the Pawcatuck River which is classified SC in this area. The treatment plant consists of pretreatment units, two primary setting tanks, and a chlorinator. The treatment plant is scheduled to be upgraded to secondary standards by June, 1978. ((15))

P14: (9) In recent years, most of the individual domestic and commercial sewage disposal system discharges in the Watch Hill area have been eliminated by consolidation and subsurface disposal, with the result that only minor water quality problems remain. A sanitary survey of the area, to be performed by the Rhode Island Department of Health later this year, will make a detailed assessment of sewer needs. ((15)) Watch Hill is programmed for sewer service and tie-in to the Westerly treatment plant early in the 1980's, contingent upon the availability of state and local funds. ((13:20)) The design capacity of the upgraded Westerly treatment plant (to be completed by June, 1978) provides for flows from the Watch Hill area. ((7))

P15: The combined storm and sanitary sewer system in Pawcatuck Borough, Stonington, discharges into the Pawcatuck River, which is classified C along this reach. The proposed municipal (Stonington) sewerage system for Pawcatuck will eliminate these discharges sometime in 1978. ((3,42))

P16: Yardney Electric Corporation, located in Pawcatuck, Connecticut discharges sanitary, boiler blowdown, cooling and process wastewaters into the upper tidal portion of the Pawcatuck River which is classified SC in this area. After completion of the Stonington sewerage facilities, all sanitary and boiler blowdown wastewater and some process water will be diverted to the municipal system. The cooling water and the remaining process water, which contains concentrations of metals untreatable at the municipal facility, will be pretreated and discharged to the river. ((48))

P17: Cottrell Division of the Harris Intertype Corporation, also in Pawcatuck, discharges into the tidal portion of the river. This discharge includes sanitary, cooling and boiler blowdown wastewaters. The sanitary wastes will be discharged to the Stonington municipal sewerage system when it becomes operational. The cooling water and boiler blowdown wastes will continue to be discharged to the river. ((48))

E. Nonpoint Sources of Pollution

Nonpoint sources of pollution have not yet been assessed or identified in the Pawcatuck River Basin. Consistent with national priorities and strategy ((47,49)) nonpoint source problems will be addressed during Phase II (1978-1983) of the implementation of PL 92-500 through the areawide wastewater management plan (Section 208) to be prepared by the Statewide Planning Program. Potential nonpoint sources of pollution to be studied are:

1. Landfill sites
2. Individual subsurface disposal systems
3. Urban runoff
4. Erosion and sedimentation from land use practices
5. Marinas ((23: 30-39))

The effect of these nonpoint sources of pollution and alternatives for their abatement will also be determined by the "208" study which is to be completed in 1978.

PART THREE: GROWTH POTENTIAL

In determining the need for municipal wastewater collection and disposal facilities, several factors affecting the growth potential of the planning area must be considered. Determinants such as population, patterns of land development, and transportation will provide a basis for the recommendations which are found in Part Five: Municipal Facilities Requirements.

A. Population

The bulk of the population in the Pawcatuck Basin is concentrated in three urban centers: Kingston and Westerly in Rhode Island, and Pawcatuck in Connecticut. Kingston, site of the University of Rhode Island, is located in the eastern portion of the basin, in the town of South Kingstown. Westerly and Pawcatuck, in the southwestern portion of the basin, face each other at the head of navigation on the five-mile long tidal portion of the Pawcatuck River. The 1970 population of the Rhode Island-Pawcatuck Basin planning area was an estimated 38,300 people. ((33)) Table 4 presents population projections for each community in the planning area at five-year intervals to the year 1995, as well as the overall projected percent change for the period. By 1995, the total population of the planning area is projected to be about 53,600, which is a 39.9 percent increase over the 1970 population, ((26)) and makes the Pawcatuck the fastest growing of the seven Rhode Island basin planning areas.

Although most communities in the basin will experience relatively large percentages of population increase over the next 20 years, only four areas of population concentration are likely to experience large enough numerical increases to necessitate consideration for the installation of municipal sewerage systems. These areas, which are identified in the State Land Use Policies and Plan ((32:59)) and illustrated on Figure 5 (page III-7), are:

1) The Watch Hill-Avondale area, Westerly

2) The Hope Valley-Wyoming area, Hopkinton-Richmond line (Wood River)

3) The Shannock-Kenyon area, Richmond-Charlestown line (Pawcatuck River)

4) The Ashaway-Bradford area, Hopkinton-Westerly line (Pawcatuck River)

B. Patterns of Land Development

The need for sewage collection systems must also be predicated on the nature of the development which is planned for an area. Since the population within the basin is expected to increase substantially within the next 20 years, it is extremely important that development to accommodate this population increase occur in an orderly fashion.

TABLE 4

Population Trends and Projections (1970-1995) ((33,26: 20,21))

Pawcatuck River Basin Communities, Rhode Island
(rounded to the nearest 100)

	Population Projections						Trends (1970/1995)	
Municipality	1970	1975	1980	1985	1990	1995	Numerical Change	Percent Change
Charlestown (part)	1,600	2,000	2,200	2,400	2,500	2,600	1,000	62.5
Exeter	3,200	4,000	4,400	4,600	4,800	4,900	1,700	53.1
Hopkinton	5,400	6,100	6,500	6,800	7,000	7,300	1,900	35.2
North Kingstown(part)	1,200	1,000*	1,300	1,600	2,000	2,300	1,100	91.7
Richmond	2,600	3,100	3,600	3,800	4,000	4,200	1,600	61.5
South Kingstown(part)	7,500	9,400	9,600	9,800	10,200	10,600	3,100	41.3
Westerly (part)	16,300	17,100	17,900	18,800	19,800	20,700	4,400	27.0
West Greenwich(part)	500	700	800	800	900	1,000	500	100.0
TOTALS	38,300	43,400	46,300	48,600	51,200	53,600	15,300	39.9

* Reflects Navy base closings in North Kingstown in 1973

Average Annual Growth Rate 1970-1995: 1.6%

1. Land Use

A future land use plan for the State of Rhode Island entitled State Land Use Policies and Plan was adopted by the State Planning Council on June 5, 1975. Six broad land use categories are included in the state plan: residential, commercial, industrial, governmental and institutional, airports, and open space.

> The land areas designated in the residential category are intended for housing, in addition to associated public and semi-public uses...and essential community facilities... The residential land use category includes three density levels: high, medium, and low.
>
> Residential areas in the high-density category are characterized by development at a minimum net density of four dwelling units per acre. The average net density in the high density areas throughout the state is 7.5 dwelling units per acre...High density areas would contain a limited amount of single-family housing on small lots, a substantial amount of multiple-family housing at net densities of around 20 or 30 dwelling units per acre, and some housing of much higher density in limited areas which have special site characteristics (such as downtown apartment buildings at a net density of 50 or 60 dwelling units per acre)...
>
> The...high-density residential areas tend to reflect existing urban centers throughout the state...If not already serviced, they would eventually require public water and sewer facilities, particularly in the most intensively developed areas in this density range...
>
> Residential development of medium-density, generally situated on the fringes of urban areas, ranges from one to four dwelling units per acre, net density. The average net density among all these areas throughout the state is 1.8 dwelling units per acre...The typical housing type in medium-density areas would be the single-family dwelling on a one-quarter to one-half acre lot. There would be some medium-density multiple-dwelling development, such as low-rise apartments or town houses at a net density of 15 to 20 dwelling units per acre.
>
> In medium-density areas, community facilities would be available to a slightly lesser extent than in high-density areas. Public water and sewer systems would be constructed in most of the medium-density areas within the next five to ten years...

In low-density residential areas, development is anticipated to occur at a maximum net density of one dwelling unit per acre. The average net density in the low-density areas throughout the state is 0.5 dwelling units per acre...The predominant housing type...would be the single-family detached dwelling on a large lot. Public water and sewer service would not be available during the time frame of this plan...((32: 63,64))

The land use plan includes four distinct types of commercial area, which vary according to the functions and services offered. One reason for this differentiation is to indicate the scale and nature of the public facilities (mainly transportation) which are needed to support a given type of commercial development...

The central cores of the major urban areas in the state are indicated in the land use plan as central business districts. Included are Newport, Pawtucket, Providence, Westerly, and Woonsocket...It is projected that these five areas will retain their function but that no new central business districts will develop...

Regional shopping centers are also denoted in the land use plan. This type of commercial area is generally limited to retail shopping establishments such as department stores, supermarkets, chain stores, and specialty shops, sometimes with one or two restaurants, branch banks, and movie theaters...((32: 121,122))

The commercial recreation areas "category is designed to encompass commercial recreational uses which cover large tracts of land and are more commercial than recreational in nature. Examples of commercial recreation uses are race tracks, amusement parks, sports arenas, and drive-in theaters...All are existing facilities; no future commercial developments of this nature are projected in the plan."

The general commercial areas category "consists of all large commercial areas in the state other than the three described above. It does not include commercial areas serving a single neighborhood or village and minor highway-oriented commercial areas, which are so small at the scale of the land use plan that they become absorbed into the residential category..." ((32: 123))

Also delineated in the 1990 plan is the industrial category.

> Although industrial areas in the plan were not classified by distinct types or density levels, as with residential areas, a variety of different uses were considered "industrial": extractive operations, such as gravel mining; manufacturing plants (processing, fabricating, and assembling); closely related non-manufacturing activities (warehouse and storage); public utility installations; and transportation terminals (railroad yards and port facilities), other than airports and military facilities. ((32: 97))

The need by industry for adequate facilities and services is reflected in the land use plan in that all development in the plan was initially analyzed in terms of soil conditions, topography, public sewer service, water service, and protection of water quality. All industrial areas were then analyzed through a field survey (the 1970 industrially zoned land inventory) ((25)) again in terms of site preparation, public services and facilities and the possibility of water pollution. Sites considered inappropriate for development because of any of these factors were eliminated. Thus the industrial areas comply with the land use plan's goals of minimizing pollution and providing efficient, adequate public services.((32:116))

> Large properties throughout the state (except for airports and open space, which form separate categories) used by governments, churches, schools, hospitals, and other institutions are classified as "governmental and institutional" in the land use plan...Specific types of governmental and institutional use include naval bases and other military facilities, state correctional and health facilities, cemeteries and colleges and universities...((32:123))

Determination of the areas of the land use plan to be reserved for airports was based on a series of surveys and inventories of air transportation in the state. ((22, 29, 30)) A revised summary planning report on the state airport system was completed in December, 1974.((31)) The findings of this summary report have been integrated into the Rhode Island Transportation Plan - 1990 ((28)), an element of the State Guide Plan approved by the State Planning Council on December 30, 1974.

Open space in the land use plan has been classified as recreation, conservation, or woodland and open land categories. "These three open space categories are very similar in that areas are often retained in a natural or open state and in that intended uses overlap among categories. In most large public 'recreational areas', for example, multi-use management allows different recreational uses; conservation is practiced and development is limited." ((32:116)) However, the state land use plan differentiates among these three open space categories, according to both purpose and degree of use and development.

Figure 5 illustrates the future development pattern of the Pawcatuck Basin as proposed by the state's land use plan. ((32:59)) The plan map was developed on the basis of a 92 acre grid system in order to indicate generally the proposed distribution of the various land use categories. Table 5 summarizes the proposed distribution of land use types for each community within the basis. ((32:132))

2. Transportation

Directly related to population and patterns of land development are transportation facilities and their effect on the need for municipal sewerage systems.

Four modes of transportation (water, rail, air, and highway) provide access to the Pawcatuck Basin area (See Figure 6).

a. Water

Access by water to the Pawcatuck River Basin is concentrated in Little Narragansett Bay and the Pawcatuck River estuary, where several marinas, boatyards and yacht clubs provide moorings and slips for recreational water craft. These facilities provide access to the heavily used shore-oriented recreational attractions and seasonal housing concentrated in Watch Hill, Avondale and other nearby areas of Westerly and Charlestown.

There is no marine shipping terminal in the Pawcatuck River Basin. The Port of Providence, at the head of Narragansett Bay, is the only major marine terminal facility in the state. It is primarily an oil handling port, although it also has the capacity to handle containerized and other cargo. ((35:38)) Travel time to the port from Westerly Center is approximately one hour. The port nearest Westerly Center is the New London harbor, which is outside of the Pawcatuck Basin. Travel time from New London to Westerly Center has been reduced from about one-half hour to about 20 minutes by the recently completed Westerly By-pass highway which connects U.S. Route 1 in the Westerly State Airport area to Route 2 in Connecticut (See Figure 6). The effect of this new highway on basin growth will be discussed later in this section.

b. Rail

The Pawcatuck Basin is served by limited interstate passenger, intercity commuter, and freight rail service

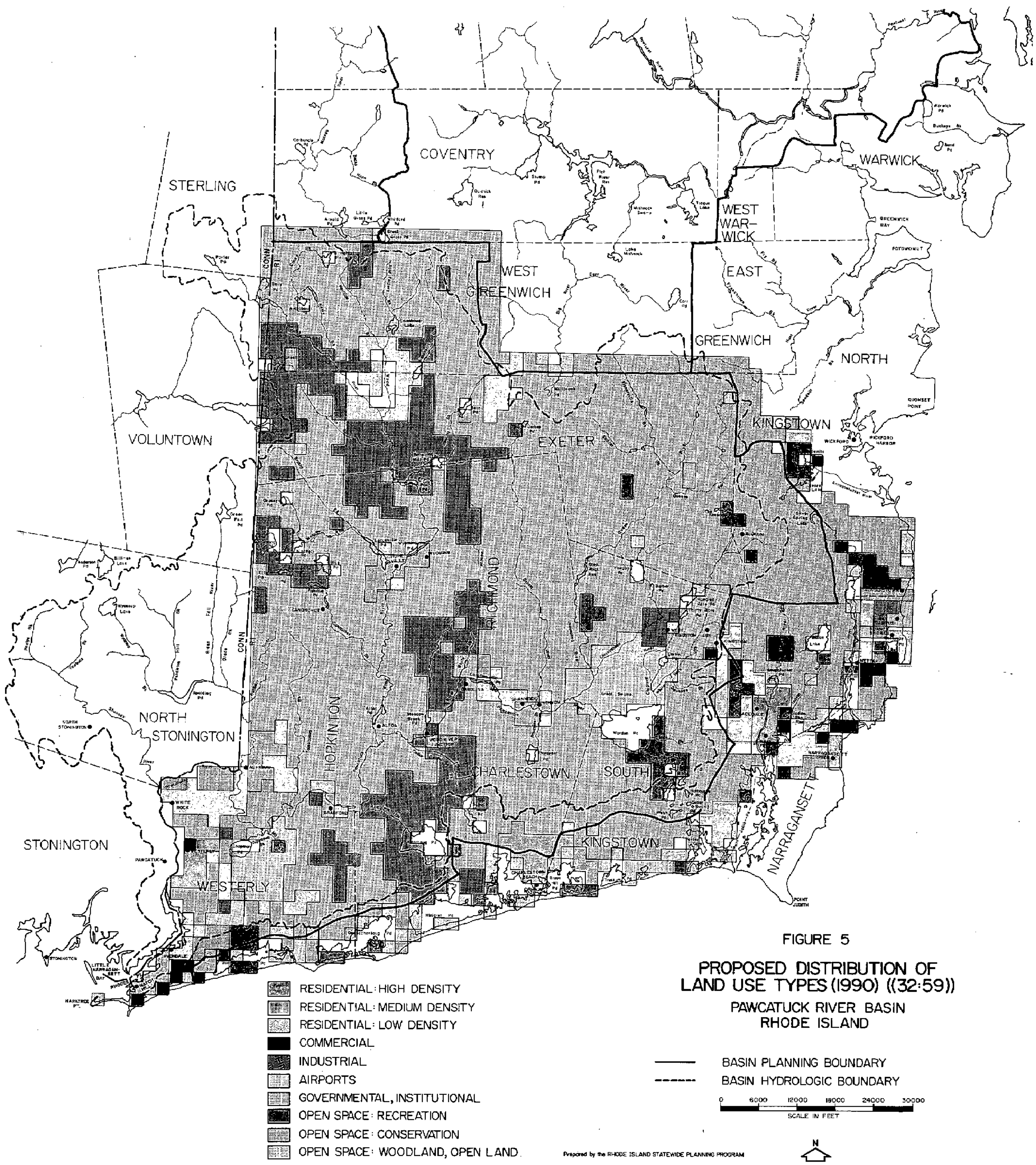


FIGURE 5

PROPOSED DISTRIBUTION OF LAND USE TYPES (1990) ((32:59))

PAWCATUCK RIVER BASIN
RHODE ISLAND

TABLE 5

Proposed Distribution of Land Use Types (1990)

Pawcatuck River Basin Communities - Rhode Island ((32))
(in acres to the nearest 100)*

	Charlestown (part)	Exeter	Hopkinton	North Kingstown (part)	Richmond	South Kingstown (part)	Westerly (part)	West Greenwich (part)	Basin Totals	Percent of Total
Residential Total	1,700	900	2,800	100	1,000	800	6,200	0	13,500	8.2
High density	0	0	0	0	0	0	800	0	800	
Medium density	1,200	100	1,500	0	500	500	2,500	0	6,300	
Low density	500	800	1,300	100	500	300	2,900	0	6,400	
Commercial	0	0	0	0	0	0	100	0	100	0.1
Industrial	0	0	0	0	100	600	300	0	1,000	0.6
Airports	0	0	0	0	0	0	400	0	400	0.2
Governmental/ Institutional	0	200	0	0	0	1,800	0	0	2,000	1.2
Open Space Total	18,100	33,000	24,300	6,800	24,000	16,700	9,200	16,600	148,700	89.7
Recreation	5,800	7,100	3,000	200	5,200	1,800	1,700	3,100	27,900	
Conservation	300	1,700	0	0	400	3,500	2,300	800	9,000	
Woodland/ Open Land	12,000	24,200	21,300	6,600	18,400	11,400	5,200	12,700	111,800	
Town Totals										
(acres)	19,800	34,100	27,100	6,900	25,100	19,900	16,200	16,600	165,700	100.0
(square miles)	30.9	53.3	42.3	10.8	39.2	31.1	25.3	25.9	258.9	

*These figures do not agree with actual land area data for the planning areas, due to the use of 92-acre grid cells in the land use plan.

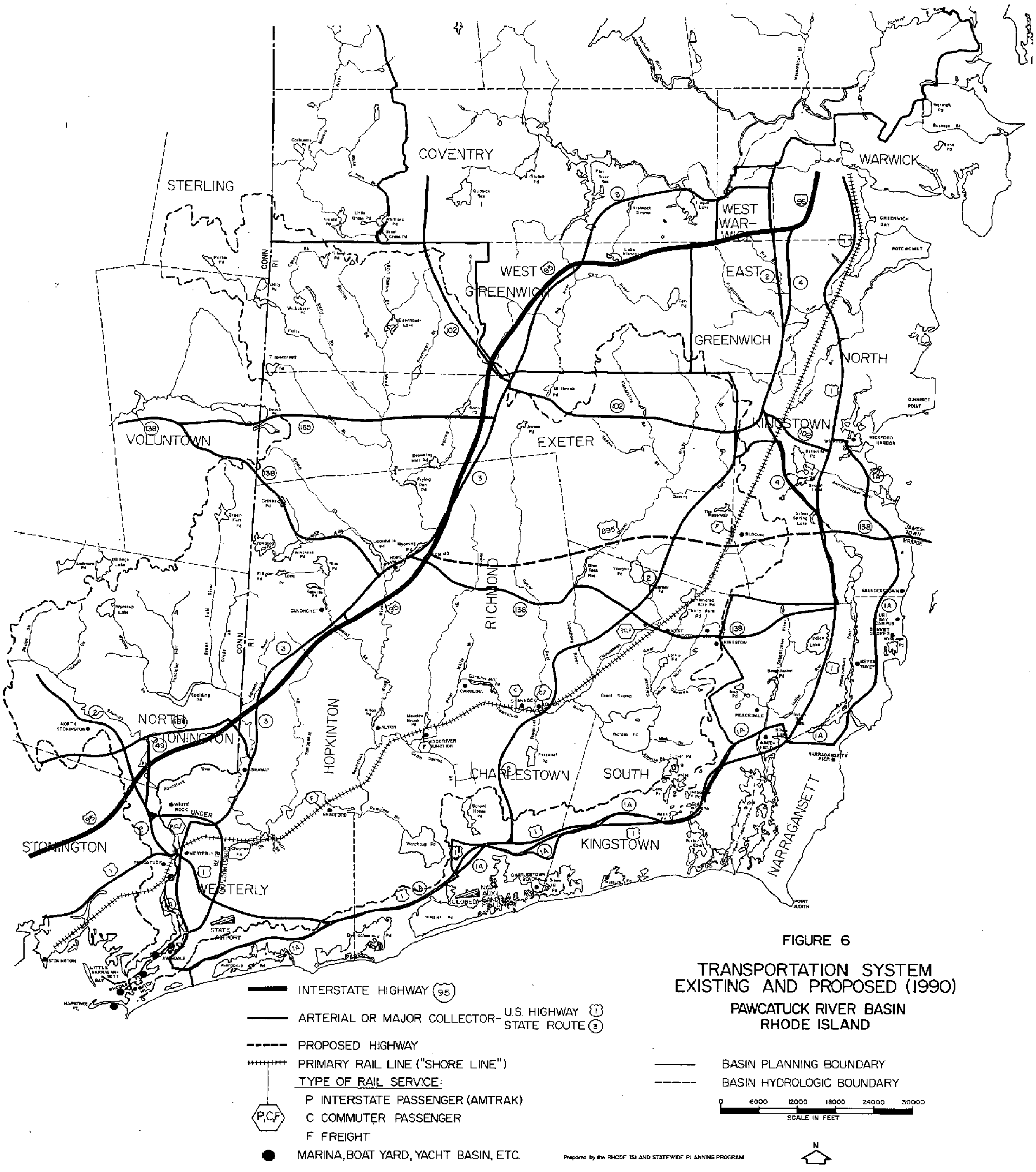


FIGURE 6

TRANSPORTATION SYSTEM
EXISTING AND PROPOSED (1990)

PAWCATUCK RIVER BASIN
RHODE ISLAND

on the "Shore Line" trackage (See Figure 6). Interstate passenger service is available at Westerly and Kingston ((27:05.65)); commuter service at Westerly, Shannock, Kenyon, and Kingston ((27:05.43)); and freight service at Westerly, Bradford, Wood River Junction, Kenyon, Kingston and Slocum.((27:05.59))

Passenger rail service to the basin is part of the AMTRAK northeast corridor service connecting Washington, D.C. and Boston. Service, both north and southbound, connects New London, Westerly, Kingston, and Providence three times daily.

Commuter rail service to the Rhode Island portion of the basin originates in Westerly and is limited to one round-trip each weekday, with stops at Westerly, Shannock, Kenyon, Kingston, Wickford Junction, East Greenwich, Warwick (Kilvert Street) and Union Station in Providence. The morning and evening Westerly-to-Providence rush hour trips cover 44 miles in 54 minutes. ((27:05.43))

During 1973, the freight terminals listed above handled nearly 500 loaded rail cars, carrying over 14,000 tons of goods, most of which were inbound.((27:05.59)) Major categories of commodities shipped included food and kindred products; lumber and wood products; chemicals and allied products; pulp, paper and allied products; and farm products.

The configuration and capacity of rail facilities in the basin appear adequate to accommodate future growth, but are not likely to induce it without the influence of other factors.

c. Air

The primary means of air access to the Pawcatuck Basin is the Westerly State Airport, which is a general aviation facility serving private, non-scheduled freight and passenger flights, as well as scheduled daily service to and from Block Island. Its two 4000-foot runways and associated facilities are capable of accommodating weather-instrumented jet and propeller aircraft weighing up to 63,000 pounds. It is approximately 2 miles from Westerly Center (See Figure 6).

Accessibility to the site has been improved by the newly-constructed Westerly By-pass highway which also serves the nearby Airport Industrial Park, as well as shore-oriented development along R.I. Scenic Route 1A and U.S. Route 1. This highway connects with Route 2 in Connecticut near the Rhode Island border (See Figure 6). The state airport facility at Westerly appears adequate to meet future growth, and no plans for expansion are currently under consideration. ((28,29: 91-98))

Several other aircraft landing facilities are available in the basin, including the former Charlestown Auxiliary Landing Field (Navy) (Figure 6), which has been declared surplus by the Navy. It served as an auxiliary landing field for the Quonset Point Naval Air Station. Development of a nuclear power generating facility at the site is under consideration. The state land use plan has designated the site industrial (See Figure 5) for the sole purpose of reserving it for further study of its use as a nuclear power plant location, and not as a general industrial site. If the site is not used for this purpose, it should be placed in open-space and low-intensity use. ((21:5)) In either case, public sewer service will not be required.

While the question of the desirability of a nuclear power plant in Charlestown is beyond the scope of this plan, some conclusions about growth in the area can be drawn. If the site is developed for a nuclear power plant, all other development would be excluded within a certain minimum radius, perhaps 0.4 miles. ((50:4)) Population density within a considerably larger radius would have to be limited to low levels. The actual dimensions of this zone of limited development would be determined by a formula including population density, meteorological, and other factors. ((5A: 18-20, 50: 4, 51: 4.7-4)) Clearly, a nuclear power plant in Charlestown would limit growth in some areas of the community.

The federal General Services Administration's decision on the disposition of the site is pending litigation by environmental interests. As a result of this court case the General Services Administration is currently preparing an environmental impact statement (EIS). Regardless of the findings of the EIS and the outcome of the litigation, it is very unlikely that this facility will remain in use as an airport, given its proximity to the Westerly State Airport.

The locations and characteristics of the other minor airparks and landing strips in the basin make it unlikely that they will affect basin growth patterns significantly. ((29: 112-126)

d. Highway

The major highway through the basin is Interstate 95 which crosses from the southwest to the northeast corner. Interstate 95, which is the primary east coast automobile and truck highway connecting the southeastern United States with the Canadian border in Maine, has eight interchanges in the basin (See Figure 6). The last three interchanges in Connecticut and the first one in Rhode Island provide access to the greater Westerly-Pawcatuck area and to seasonal shore-oriented attractions along U.S. Route 1 and R.I. Scenic 1A on Rhode Island's south coast.

The Westerly By-pass highway, which has recently been completed as state Route 78 in Connecticut and Rhode Island, serves the two-fold purpose of providing a by-pass route around the Westerly-Pawcatuck urbanized area for: (1) heavy summer traffic bound for Rhode Island beaches along U.S. Route 1 and R.I. Scenic 1A, and (2) truck and employee traffic to the 105 acre Westerly Airport Industrial Park, currently under development. The first phase in the development of this by-pass highway includes a two-lane, grade separated, controlled access highway from U.S. Route 1 near the Westerly State Airport to Connecticut Route 2 in Stonington. It was completed in June, 1976. Ultimately, the by-pass will be a four-lane, limited access highway connecting U.S. Route 1 in Westerly with an upgraded Route 2 in Stonington. Completion of this second and final phase is contingent upon the availability of funds and is probably five or more years distant. ((16)) Nevertheless, completion of Phase I accomplishes the purpose of providing relief from tourist and truck traffic for downtown streets, as well as providing improved access and growth stimulation for the industrial park.

U.S. Route 1 and R.I. Scenic 1A, as noted above, provide access to beaches and associated seasonal development along Rhode Island's southern coast. Development adjacent to these two routes may be accelerated by improved access over the Westerly By-pass.

U.S. Route 1 is a four-lane limited access coastal highway crossing the basin east to west, carrying local and through auto and truck traffic to points along Block Island Sound, Narragansett Bay and inland. Some reconstruction to increase control of access is proposed for Route 1 ((28:II-10)), but is not likely to affect growth significantly.

The two-lane Scenic Route 1A is the only available route to seasonal developments at Watch Hill and Avondale on Little Narragansett Bay and the Pawcatuck estuary, and to the popular Misquamicut beach area on Block Island Sound. Minor improvements are planned for Route 1A in Westerly, ((28:II-15)) but should not affect development.

Other important basin highways include Connecticut Route 2 and Rhode Island Routes 2, 3 and 138. Connecticut Route 2 is a north-south arterial highway joining Pawcatuck Borough, North Stonington Borough and Norwich. Rhode Island Route 2 is the major north-south arterial in the eastern portion of the basin. From its southern terminus at U.S. 1 in Charlestown Village, Route 2 runs north-north-east to Providence, passing through Kenyon and near the University of Rhode Island.

R.I. Route 3, prior to the construction of I-95, was the basin's major north-south route from southeastern Connecticut to the Providence area. It passes through the western portion of the basin, parallelling I-95 and linking Hope Valley-Wyoming, Ashaway and downtown Westerly.

Route 138 crosses the basin east-west, connecting Voluntown, Connecticut and the East Bay area of Rhode Island through Hope Valley-Wyoming, URI, Kingston and communities on the mid-bay islands. It is a heavily travelled, winding, two-lane arterial with a high accident rate.

A study recently initiated by the R.I. Department of Transportation will determine the recommended location of a proposed interstate highway (Interstate 895) to carry the heavy cross-state truck and auto traffic now handled by R.I. 138. This highway would also provide a safe, efficient route for the high volume of summer recreational traffic bound from Connecticut and New York to Newport and Cape Cod. The western terminus of the proposed Interstate 895 would be at the existing I-95 interchange at Hope Valley-Wyoming. After crossing western Rhode Island, it would join the new stretch of R.I. 138 between U.S. 1 and the Jamestown Bridge in North Kingstown (Figure 6). Preliminary planning indicates that an interchange should be provided north of the West Kingston-URI area of South Kingstown. This interchange would serve the West Kingston industrial park proposed by the state land use plan and zoned as such by the Town of South Kingstown. Access to the University of Rhode Island would also be provided by the interchange. Construction of I-895 can be expected to increase development potential and pressure in both Hope Valley-Wyoming and West Kingston-URI areas. ((28: II-20 to II-22)) An Environmental Impact Statement on I-895 is currently being prepared by a consultant to the Rhode Island Department of Transportation, and should be completed by mid-1977.

Two arterial roads cross the northern portion of the basin. State Route 165 crosses the western half of the Town of Exeter, connecting State Route 138 in Connecticut with R.I. Route 3. Rhode Island Route 102 is the primary north-south arterial in the north-west quadrant of the state. Its southern stretch passes east-west across the northern portion of the planning area, serving as a major connector between I-95 and U.S. Route 1.

Bus service in the planning area is limited to intercity and interstate runs, with no local transit routes. Greyhound Bus Lines serves Westerly on the daily Providence to New York run, while Bonanza Bus Lines provides daily service from Providence to the University of Rhode Island, with a stop at Davisville. The Rhode Island Public Transit Authority provides frequent runs along two intercity routes which serve the eastern end of the planning area: (1) Newport-Jamestown-Narragansett Pier-Wakefield-URI-West Kingston, and return; and (2) URI-Wakefield-Galilee-Point Judith and return.((10A))

PART FOUR: SEGMENT CLASSIFICATIONS AND ANALYSES

A. Water Quality Planning Goals

One of the major goals of the state land use plan is to "make efficient use of available land and water, producing a visually pleasing, coherent, and workable environment."((32:8)) The state water quality management plan is guided by this same general goal and by more specific goals: to "reduce stream pollution to levels set in the state's Stream Classification Plan" and to aid in the "coordinated development, conservation, and use of the state's water resources." ((18:11,14))

Another goal in the basin plan is the application of effluent limits specified in the Water Pollution Control Act Amendments of 1972 (PL 92-500) under Section 301(b), which are:

(1.) (A). By July 1, 1977, effluent limits applying best practicable treatment by industry as defined by the Administrator (under section 304b) or treatment to meet pre-treatment standards (under section 307).

(B). By July 1, 1977, effluent limits applying secondary treatment as defined by the Administrator (section 304d(1)) for publicly owned treatment works in existence on July 1, 1977 or approved prior to June 30, 1974 with four years allowed for completion.

(C). By July 1, 1977, any more stringent limitations including those necessary to meet water quality standards, treatment standards, or schedules of compliance.

(2.) (A). By July 1, 1983, effluent limits applying the best available technology for industries which is economically achievable for that category of point source as defined by the Administrator (Section 304(b)(2)), including the elimination of the discharge.

(B). By July 1, 1983, effluent limits applying the best practicable treatment for the publicly owned treatment works.

B. Segment Classification

The Pawcatuck River Basin has been divided into effluent limitation and water quality class segments, according to the following definitions:

Effluent Limitation Class - Water quality standards are now being met or there is certainty that water quality standards will be met by the application of effluent limitations required by Sections 301(b)(1)(A) and 301(b)(1)(B), of the Act.

Water Quality Class - desired water quality standards will not be achieved even after the application of effluent limitations required by Sections 301(b)(1)(A) and 301(b)(1)(B), of the Act.

The water quality and effluent limitation segments for the Pawcatuck Basin are shown on Figure 7 and their characteristics summarized in Table 6. The segment classifications were assigned by the Rhode Island Department of Health on the basis of whether or not the water quality classification could, in their judgement, be met by secondary or best practicable treatment.

All Class A and Class B waters have been classified as water quality segments because ultimately there will be no discharges allowed to these segments with the exception of non-contact cooling water. Because of this non-degradation provision, no degree of treatment requiring a discharge to these segments will be sufficient to meet the water quality classification.

A **segment** priority ranking for all segments in the state was developed by the Rhode Island Department of Health on the basis of the following major criteria:

1) severity of problem

2) population affected; and

3) need for the preservation of pure waters. ((24:12))

The priority points for the segments of the Pawcatuck River basin are shown on Figure 7 and are listed in Table 6. The basin abatement priority ranking, also listed in Table 6, is a ranking among the segments of the basin assigning priority to the need for the abatement of the pollution within that segment. The segment with the greatest number of priority points in a basin is assigned the highest abatement priority ranking for the basin. The method used in assigning priority points to each segment is detailed in Appendix C.

C. Segment Analyses

1. Water Quality Segments

There are 27 water quality segments in the Pawcatuck Basin, seven of which are out of compliance with their water quality classification. These seven segments are identified and described in Table 7. An analysis of each water quality segment in the basin, based on Department of Health records, is given below.

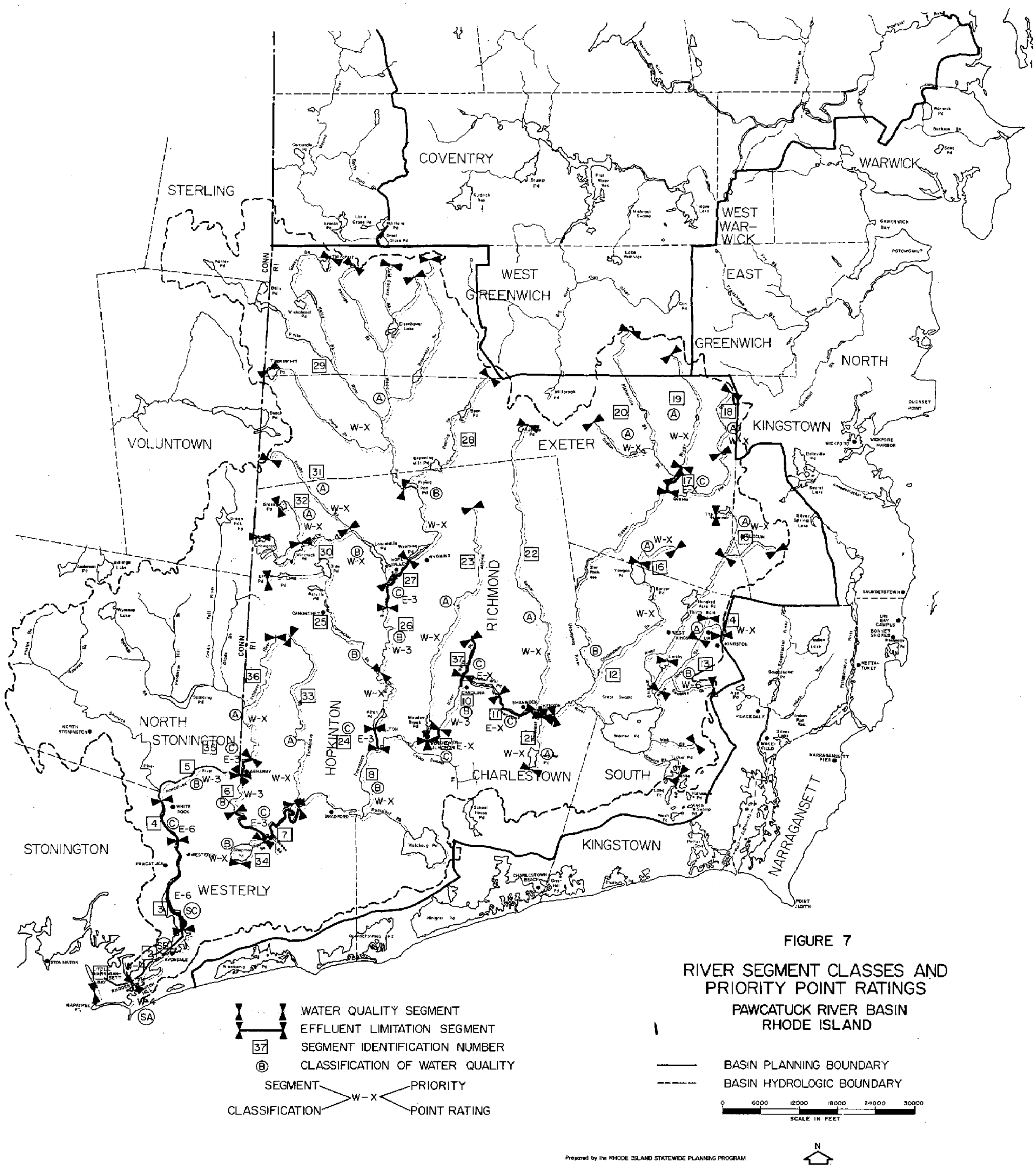


FIGURE 7

RIVER SEGMENT CLASSES AND PRIORITY POINT RATINGS

PAWCATUCK RIVER BASIN RHODE ISLAND

TABLE 6

Characteristics of River Segments

Pawcatuck River Basin ((15))

Segment Identification Number	Stream Name	Total Length (miles) or Area	Water Quality Classification	Out of Compliance	Segment Class[a]	Discharge Number(s)	Segment Priority Points[b]	Segment Priority Ranking
1	Little Narragansett Bay	770 ac.	SA	Yes	W	P14	4	5
2	Pawcatuck River Estuary	(260 ac.)						
		2.3	SB	Yes	W	None	4	5
3	Pawcatuck River Estuary	(210 ac.)						
		3.0	SC		E	P13,P16,P17	6	1
4	Pawcatuck River	1.0	C		E	P15	6	1
5	Pawcatuck River	3.6						
	Shunock River, Etc.	27	B	Yes	W	None	3	7
6	Pawcatuck River	1.7	B	Yes	W	None	3	7
7	Pawcatuck River	4.4	C		E	P11	3	7
8	Pawcatuck River	8.0						
	Poquiant Brook, Etc.	8	B		W	None	X	None
9	Pawcatuck River	0.6	C		E	P6	X	None
10	Pawcatuck River	3.2	B	Yes	W	None	3	7
11	Pawcatuck River	1.9	C		E	P4	6	1
12	Pawcatuck River	2.5						
	Queen River, Etc.	45	B		W	None	X	None
13	White Horn Brook, Etc.	7	B	Yes	W	P2,P3	6	1
14	White Horn Brook, Etc.	2	A		W	None	X	None
15	Chipuxet River, Etc.	7	A		W	None	X	None
16	Chickasheen Brook	1.5	A		W	None	X	None
17	Queen's River	0.6	C		E	P1	X	None
18	Unnamed	4	A		W	None	X	None
19	Queen's River, Etc.	8	A		W	None	X	None
20	Sodom Brook, Etc.	12	A		W	None	X	None
21	Pasquiset Brook	2.0	A		W	None	X	None
22	Beaver River, Etc.	12	A		W	None	X	None
23	Meadow Brook, Etc.	8	A		W	None	X	None
24	Wood River	0.7	C		E	P7	3	7
25	Wood River	2.7						
	Canonchet Brook, Etc.	10	B		W	P8	X	None
26	Wood River	2.4	B	Yes	W	None	3	7
27	Wood River	1.8	C		E	P9	3	7
28	Wood River	3.4						
	Roaring Brook, Etc.	6	B		W	None	X	None
29	Wood River							
	Falls River, Etc.	48	A		W	None	X	None

TABLE 6

Characteristics of River Segments

Pawcatuck River Basin ((15))
(Continued)

Segment Identification Number	Stream Name	Total Length (miles) or Area	Water Quality Classification	Out of Compliance	Segment Class[a]	Discharge Number(s)	Segment Priority Points[b]	Segment Priority Ranking
30	Brushy Brook, Etc.	8	B		W	P10	X	None
31	Brushy Brook, Etc.	5	A		W	None	X	None
32	Unnamed	2.1	A		W	None	X	None
33	Tomaquaug Brook, Etc.	10	A		W	None	X	None
34	Aquntaug Brook	1.4	B		W	None	X	None
35	Ashaway River	0.9	C		E	P12	3	7
36	Ashaway River, Etc.	37	A		W	None	X	None
37	White Brook	1.7	C		E	P5	X	None
TOTAL LENGTHS:		288.0 mi.						

a - E-Effluent Limitation
W-Water Quality

b - X - No problem
See Appendix C for details of points assignments

TABLE 7

River Segments Out Of Compliance With
Rhode Island Department of Health Standards

Pawcatuck River Basin ((15))

Segment Number	Segment Class*	Name of Stream or Water Body	Classification of Water Quality: Proposed	Classification of Water Quality: Existing	Length or Area Out of Compliance	Discharge(s) Affecting Water Quality
1	W	Little Narr. Bay	SA	SB	770 acres	P14 Watch Hill individual sewers (minor) P13 Westerly sewage treatment plant P17 Harris Intertype Corp., Cottrell Division P16 Yardney Electric Corp. P15 Pawcatuck combined sewers
2	W	Pawcatuck River Estuary	SB	SC	2.3 miles (260 acres)	P13 Westerly sewage treatment plant P17 Harris Intertype Corp. Cottrell Division P16 Yardney Electric Corp. P15 Pawcatuck combined sewers
5	W	Pawcatuck River	B	C	3.6 miles	P12 Ashaway individual sewers
6	W	Pawcatuck River	B	C	1.7 miles	P11 New Bradford Dyeing Assoc
10	W	Pawcatuck River	B	C	2.5 miles	P4 Kenyon Piece Dye Works
13	W	White Horn Brook	B	C	1.7 miles	P2 University of Rhode Island boiler blowdown P3 University of Rhode Island treatment plant
26	W	Wood River	B	C	2.4 miles	P9 Hope Valley individual sewers

* E - Effluent Limitation

W - Water Quality

Segment 1: (770 acres) Little Narragansett Bay from Napatree Point to the mouth of the Pawcatuck River at Rhodes Point is designated Class SA by the Department of Health. It is out of compliance with this designation and closed to shellfishing due to industrial, municipal and individual discharges to Segments 3 and 4. Although the severity of pollution is slight, it affects an extensive population because of the closure of shellfishing beds. For this reason, the segment has been assigned four priority points (See Appendix C). Most of the individual domestic and commercial discharges in the Watch Hill area of Westerly have been eliminated in recent years by consolidation and in-ground disposal, but, in order to protect water quality and provide for elimination of any remaining discharges, sewer service is programmed for the area for the early 1980's. ((13:20)) The exact timing of facilities construction is uncertain, as it is contingent upon the availability of federal, state and local funds. A detailed sanitary survey of Watch Hill will be performed by the Rhode Island Department of Health later this year. ((15))

Segment 2: (2.3 miles; 260 acres) The lower reach of the Pawcatuck River Estuary from its mouth at Rhodes Point to Pawcatuck Rock is classified SB. This segment is also out of compliance with its designated class due to upstream discharges in Segments 3 and 4. This segment's four-point priority rating is detailed in Appendix C. The discharges to Segment 3 include the Westerly municipal primary treatment plant (P13), the Yardney Electric Company discharge (P16), and the Harris Intertype Corporation, Cottrell Division discharge (P17). Combined storm and sanitary sewer discharges in Pawcatuck (P15) on Segment 4 also contribute to problems in Segment 2. The upgrading of the Westerly treatment plant and the construction of a sanitary sewer system in Pawcatuck will bring this segment into compliance with its SB classification.

Segment 5: (main stem: 3.6 miles) This segment of the Pawcatuck River main stem extends from the Bridge Street crossing in the White Rock section of Westerly to the confluence of the Ashaway River. The Shunock River in North Stonington, Connecticut, is a major tributary to this segment. The main stem portion of Segment 5 is out of compliance with its B classification as a result of discharge P12 (Ashaway Village) on Segment 35. Because of the effects of this discharge, Segment 5 has received three priority points.

Segment 6: (1.7 miles) This portion of the main stem from the Ashaway River confluence to the R.I. Route 3 crossing is out of compliance with its B classification, because of pollutional loadings from the New Bradford Dyeing Association (Discharge P11) on Segment 7, immediately upstream. Additional treatment of the

Bradford Dyeing discharge by means of a neutralization pond may allow Segment 6 to attain Class B water quality. The neutralization pond is scheduled to go on line in November, 1976, and be observed for about one year to determine its effectiveness in improving water quality in Segments 6 and 7. Domestic wastes from nearby homes will continue to discharge to the Dyeing Association lagoon, as the presence of the nutrients in this type of waste is desirable for vigorous bacteriological activity in the lagoon. Segment 6 is assigned a three-point priority rating until it attains Class B water quality. (See Appendix C).

Segment 8: (main stem: 8.0 miles) This segment, in the middle portion of the Pawcatuck main stem, reaches from Kedinker Island near Discharge P11 (New Bradford Dyeing Association) to the confluence of Meadow Brook. Poquiant Brook, Watchaug Pond, Cedar Swamp Brook and Indian Cedar Swamp are also included in this segment, which is Class B. A "no problem" (X) priority rating has been assigned to this segment.

Segment 10: (3.2 miles) A Class B segment, this stretch of the main stem extends from the United Nuclear Corporation discharge (P6) to the head of Carolina Mill Pond. This segment is out of compliance for most of its length, due to the Kenyon Piece Dye Works discharge (P4--Segment 11). Upgrading of treatment for this discharge is projected for November, 1976 and should result in compliance for Segment 10. Until brought into compliance, the segment will carry a priority point rating of three.

Segment 12: (main stem: 2.5 miles) Most of the Class B headwaters of the Pawcatuck River main stem are included in this segment, which has a "no problem" (X) priority point rating. The downstream end of this segment is at the Kenyon Piece Dye Works discharge (P14). The segment includes the upper reach of the Pawcatuck River from Kenyon to the Great Swamp and Worden Pond, as well as Alewife Brook and Tucker Pond. The lower portion of the Usquepaug-Queen's River complex (which includes Glen Rock Reservoir, Glen Rock Brook, the lower Queen's River, and an unnamed tributary) is also part of Segment 12. The lower Chickasheen Brook, including Yawgoo and Barber Ponds, is part of the segment, as is the lower Chipuxet River, including Thirty Acre Pond and Hundred Acre Pond.

Segment 13:(approx. 7 miles) The lower reach of the White Horn Brook to its confluence with the Chipuxet River is classified B, but is not in compliance with this designation. Water quality here is degraded by the University of Rhode Island discharges (P2 and P3). The sanitary and laboratory wastewater presently treated at the University's secondary treatment plant (P3) is scheduled for diversion to the South Kingston treatment facility in Narragansett by mid-1977. The University has informed the Department of Health that it will divert its boiler blowdown discharge (P2) to a sub-surface disposal system, but has not made a construction timetable available. The elimination of discharges P2 and P3 will allow Segment 13 to be in compliance with its B classification. ((15)) The segment will continue to have a six-point priority rating until that time, as noted in Appendix C. The segment also includes Genesee Brook, which is unaffected by the URI discharges.

Segment 14: (approx. 2 miles) The Class A waters of the upper White Horn Brook have received an X priority point rating ("no problem").

Segment 15: (approx. 7 miles) The upper reaches of the Chipuxet River are Class A and have a "no problem" (X) rating.

Segment 16: (1.5 miles) The upper reach of the Chickasheen Brook above Yawgoo Pond is also Class A, with a "no problem" (X) rating.

Segment 18: (approx. 4 miles) This segment is comprised of an unnamed Class A tributary of the Queen's River, and has an "X" (no problem) priority point rating.

Segment 19: (approx. 8 miles) The uppermost reach of the Queen's River above the Ladd School discharge (P1) extends into West Greenwich and includes Edwards Pond. It is Class A, with no problems and an "X" priority rating.

Segment 20: (approx. 12 miles) The Class A headwaters of the Queen's River, which include Pendock, Fishersville, Dutemple and Sodom Brooks and Dolly and Hallville Ponds have no problems (X priority point rating).

Segment 21: (2.0 miles) Pasquiset Brook and its headwater pond comprise this Class A, "no problem" (X priority point rating) segment, which joins the Pawcatuck main stem at Kenyon.

Segment 22: (approx. 12 miles) The Beaver River, which flows due southward from Exeter to join the Pawcatuck main stem at Shannock is a Class A, "no problem" (X priority point rating) stream which includes James Pond at its head.

Segment 23: (approx. 3 miles) The Class A Meadow Brook joins the main stem of the Pawcatuck River at Wood River Junction after passing through Meadow Brook Mill Pond. The segment has an "X" priority point rating.

Segment 25: (Wood River: 2.7 miles) This segment includes the lower portion of the Wood River between the discharge from Charbert, Incorporated (P7) at Alton and the confluence of Canonchet Brook. It also includes the tributary Canonchet Brook; Union Mill Pond at Canonchet Village, where the Green Plastics Corporation discharge (P8) enters; and Asherville, Blue, Ell, and Long Ponds. The segment has an "X" priority point ranking.

Segment 26: The 2.4 mile-long reach of the Wood River between the Canonchet Brook confluence and the USGS streamflow gaging station (See Figure B-1, Appendix B) is out of compliance with its B classification due to individual domestic and commercial sewerage system discharges to Segment 27 in Hope Valley (P9).

The nature of these discharges has necessitated the Health Department's downgrading of this portion of the stream, as bathing and recreation here may be unsafe. A determination of the severity of the pollution from Hope Valley will be made under the Section 208 areawide waste treatment management planning program. Recommendations for abatement, if it is required, will be made through the 208 program. ((23:23)) Segment 26 has received a three-point priority rating (Appendix C).

Segment 28: (Wood River: 3.4 miles) The middle reach of the Wood River above the Wyoming Pond dam is classified B as far as Frying Pan Pond and the confluence of Roaring Brook. This reach of the Wood River plus Roaring Brook, which includes Browning Mill Pond and Boon Pond, comprise Segment 28, which has a "no problem" (X) priority rating.

Segment 29: (approx. 48 miles) Several Class A streams extending from Exeter into the towns of West Greenwich, Rhode Island and Sterling and Voluntown, Connecticut comprise the headwaters of the Wood River. These streams and their associated ponds are assigned a "no problem" (X) priority rating and include: Woody Hill Brook, Parris Brook and Tippecansett Pond, Falls River and Porter and Hazard Ponds, Carson River and Bailey Pond, Kelley Brook and Wickaboxet Pond, Coney Brook and Tillinghast Pond, Phillips Brook, Acid Factory Brook and Eisenhower Lake (Louttit Pond), and Breakheart Brook and Pond.

Segment 30: (approx. 8 miles) Brushy Brook, from its confluence with the Wood River at Hope Valley to its confluence with Moscow Brook is a Class B stream. This portion of Brushy Brook, along with Moscow Brook and Wincheck and Yawgoog Ponds, comprises a "no problem" (X priority point rating) segment. Auralux Chemical Corporation discharges cooling water to this segment (P10).

Segment 31: (approx. 5 miles) Brushy Brook above its confluence with Moscow Brook, is a Class A, "no problem" (X priority point rating) segment.

Segment 32: (2.1 miles) This segment is the Class A unnamed tributary of the Moscow Brook which feeds Wincheck Pond. It includes Grassy Pond and has a "no problem" (X) priority point rating.

Segment 33: (approx. 10 miles) The Class A Tomaquaug Brook flows in a southerly direction through central Hopkinton to join the Pawcatuck main stem at Kedinker Island west of Bradford. The segment has an "X" (no problem) priority point rating.

Segment 34: (1.4 miles) This "no problem" segment is comprised of the Class B Chapman Pond and Aguntaug Brook in Westerly.

Segment 36: (approx. 37 miles) The upper Ashaway River above the Village of Ashaway is a Class A stream with a "no problem" rating. In addition to the upper Ashaway River this segment includes Parmenter and Wine Brooks in Rhode Island and the following Connecticut waters: Green Fall River and Pond; Wyassup Brook and Lake; Spaulding Pond; and Hetchel Swamp, Pendleton Hill, Glade and Peg Mill Brooks.

2. Effluent Limitation Segments

Ten of the 37 segments in the Pawcatuck Basin are effluent limitation segments, all of which are classified C or SC by the Department of Health. While none of these segments is out of compliance with its designated class, the level of pollutional loading on several of these exceeds the assimilative capacity of the segment, thereby degrading the quality of downstream segments. The descriptions of effluent limitation segments which follow are based on Division of Water Pollution Control files.

Segment 3: (3.0 miles; 210 acres) This Class SC segment of the Pawcatuck River Estuary, which extends from Pawcatuck Rock to the Stillmanville Dam in downtown Westerly, receives three discharges: the discharge from the Westerly treatment plant (P13), which provides only primary treatment at present; the Yardney Electric Corporation discharge (P16); and the Harris Intertype Corporation, Cottrell Division discharge (P17). Both industrial dischargers are in Pawcatuck, Connecticut. While the segment itself is in compliance with its Class SC designation, bacterial concentrations in Segments 1 and 2 downstream exceed permissible limits because of discharges to this segment and to Segment 4 immediately upstream. This segment has been assigned six priority points (See Appendix C) because of the moderate pollution caused by point source discharges to it.

Problems in Segments 1, 2, 3, and 4 will be alleviated by actions currently underway. The upgrading of the Westerly facility to secondary treatment should be complete by June, 1978. The Yardney and Harris industrial discharges (P16 and P17) will be almost totally eliminated when they tie into the proposed Stonington (Pawcatuck) municipal system, possibly as soon as 1978. The secondary-treated effluent from the Pawcatuck plant will discharge to the Pawcatuck River in Segment 3, about one-half mile below the Westerly treatment plant outfall.

Segment 4: (1.0 miles) This Class C segment is the first non-tidal reach of the Pawcatuck main stem. It lies between the Stillmanville Dam in Westerly Center and the Bridge Street crossing in the White Rock section of Westerly. The segment has been assigned six priority points because of moderate pollution caused by flows from the combined sewer system in Pawcatuck (P15). These flows contribute to the degradation of segments 1 and 2, downstream. The combined sanitary and storm flows will be separated, and sanitary flows will be treated by the Stonington (Pawcatuck) municipal system. As construction of the system will require approximately two years, these flows will not be eliminated and segments 1 and 2 brought into compliance before 1978. ((42))

Segment 7: (4.4 miles) This Class C segment of the Pawcatuck main stem reaches from the R.I. Route 3 crossing to the New Bradford Dyeing Association discharge (P11) upstream of Kedinker Island. Although this segment is in compliance with its C classification, the level of pollutional loading degrades water quality in the Class B segment immediately downstream (Segment 6).

Segment 7 has been assigned three priority points, as detailed in Appendix C. This priority rating is a result of the New Bradford Dyeing Association discharge (P11), which is scheduled for upgrading by November, 1976. At that time a neutralization pond between the plant and the lagoon will go on line. If, after about a one-year trial period, this treatment proves inadequate, aerators may have to be installed in the lagoon. ((15))

Segment 9: (0.6 miles) This short stretch of Class C water lies on the Pawcatuck main stem between the Meadow Brook confluence and the United Nuclear Corporation discharge (P6). This "no problem" (X) priority segment is restricted to Class C or lower uses as a precautionary measure in order to discourage swimming near the industrial discharge.

Segment 11: (1.9 miles) The reach of the Pawcatuck main stem from the head of Carolina Mill Pond to the Kenyon Piece Dye Works discharge (P4) is a Class C segment, with a priority point rating of six as a result of the moderate pollution caused by the Dye Works discharge. Most of Segment 10 immediately downstream is out of compliance with its Class B designation because of high bacterial concentrations. Upgrading of treatment at the existing aerated lagoon at the Kenyon Works will include additional aeration, a settling pond and possible chlorination, and is projected for a November, 1976 completion date. These improvements should bring Segment 10 into compliance with Class B standards.

Segment 17: (0.6 miles) The Joseph H. Ladd School discharges (P1) secondary-treated domestic wastewater to the upper Queen's River. For precautionary reasons the segment is classified C to discourage recreational usage. Because treatment of the school's effluent is adequate at present and has no impact on downstream segments, the stream has received a "no problem" (X) priority point rating.

Segment 24: (0.7 miles) The lower end of the Wood River from the Charbert discharge (P7) to the Pawcatuck River confluence has been assigned three priority points (See Appendix C). Although the segment is in compliance with its C classification and has little or no adverse impact on downstream segments, the discharge does cause a slight pollution problem within this segment. A design for seepage pits to receive this discharge is currently under preparation. Construction should be completed by December, 1976, after which the segment may be reclassified to Class B if treatment is adequate.

Segment 27: (1.8 miles) The middle reach of the Wood River from the U.S.G.S. streamflow gaging station south of Hope Valley to the Wyoming Pond Dam receives discharges from individual sewage disposal systems in Hope Valley (P9). Although these discharges do not affect the C classification of this segment, they do cause the downstream Segment 26 to be out of compliance with its B classification because of high bacterial concentrations. The segment has therefore been assigned three priority points (See Appendix C). The steps necessary to abatement of these discharges will be determined under the Section 208 areawide waste treatment management planning program during the 1977 and 1978 fiscal years. ((23:23)) Progress toward elimination of the problem may be expected to begin after completion of the 208 plan in 1978.

Segment 35: (0.9 miles) The lower reach of the Ashaway River, from its confluence with the Pawcatuck River to the Ashaway Road crossing, is a Class C stream which receives discharges from individual sewage disposal systems in Ashaway Village (P12). The segment has been assigned a three-point priority rating, as discharges to it degrade stream quality slightly in Segment 5 on the main stem. A system of interceptor and collector sewers to eliminate these discharges is tentatively programmed for construction and tie-in to the Westerly municipal system. The details of the system have not yet been determined. ((15))

Segment 37: (1.7 miles) The Class C White Brook joins the Pawcatuck main stem in Segment 10 below Carolina Mill Pond. American Fish Culture discharges process water to the segment through a series of settling ponds which provide adequate treatment. This segment has been assigned a "no problem" (X) priority rating.

D. Discharge Treatment and Target Abatement Dates

The existing and proposed treatment for the seventten discharges in the basin are summarized in Table 8. This table also includes the estimated dates by which the discharges will be eliminated or upgraded, if so required. The information in Table 8 is derived from the provisions of NPDES permits, and from Department of Health records and estimates of completion dates for municipal facilities currently under development.

The present and anticipated status of the Pawcatuck River main stem and three tributaries in relation to the water quality goals of the Water Pollution Control Act Amendments of 1972 (P.L. 92-500), which were discussed on page IV-1, are summarized in Table 9.

Segment 1 is omitted from Table 9 because it encompasses an open water area (Little Narragansett Bay) which cannot be meaningfully expressed as a length in miles, as all other segments are. Segment 1 is expected to meet both 1977 and 1983 goals by 1978, when the new Pawcatuck and the upgraded Westerly treatment facilities are expected to begin operations. The segment is expected to attain Class A water quality at that time. ((15))

Segment 2 is expected to attain Class B water quality and meet both the 1977 and the 1983 goals upon completion of the Pawcatuck and Westerly treatment plants in 1978. ((15))

Segment 3 receives several discharges as noted on page IV-11. The completion of the Pawcatuck sewer system and the upgrading of the Westerly treatment plant will allow this segment to meet the 1977 and the 1983 goals by 1978. By Department of Health policy, it cannot receive a classification higher than Class C.

Segment 4 should attain Class B and the 1977 and 1983 goals by 1978, if the new Pawcatuck sewer system is completed during that year. ((15))

Segment 5 is out of compliance with its B classification because of inadequate individual sewage disposal systems in Ashaway Village (P12--Segment 35). A system of sewers for the village, to be tied into the Westerly system at White Rock, is proposed, but has not yet been designed, scheduled or funded. ((15)) Given these facts, Segment 5 is not expected to meet either set of goals by 1983.

Segment 6 is degraded by the New Bradford Dyeing Association discharge (P11) to segment 7. This discharge is scheduled for upgrading late this year, which should allow segment 6 to meet the 1977 and 1983 goals by 1978. ((15))

TABLE 8

Discharge Treatment and Target Abatement Dates

Pawcatuck River Basin ((15,48))

Discharge Number	Segment Number	Segment Class*	Name of Discharger	Treatment: Present	Treatment: Proposed	Compliance or Target Abatement Date
P1	17	E	Ladd School	Secondary	No change	-
P2	13	W	Univ. of Rhode Island Boiler Blowdown	None	Elimination by subsurface disposal	Not available
P3	13	W	Univ. of Rhode Island Treatment Plant	Secondary	Tie into S.Kingstown regional facility	March 1977
P4	11	E	Kenyon Piece Dye Works	Aerated lagoon	Settling lagoon, additional aeration, possible chlorination	November 1976
P5	37	E	American Fish Culture	Settling ponds	No change	-
P6	9	E	United Nuclear Corp.	None (cooling water)	No change	-
P7	24	E	Charbert, Inc.	Lagoon	Elimination by inground disposal (seepage pits, in design phase)	December 1976
P8	25	W	Greene Plastics,Corp.	None(cooling water)	No change	-
P9	27	E	Hope Valley Individual Sewage Systems	Inadequate	To be determined under Section 2 areawide waste treatment plannin	
P10	30	W	Auralux Chemical Corp.	None(cooling water)	No change	-
P11	7	E	New Bradford Dyeing Assoc.	Lagoon	Neutralization pond	November 1976
P12	35	E	Ashaway Individual Sewage Systems	Inadequate	Interceptor and collector sewers tied into Westerly municipal system	Not yet Established

TABLE 8

Discharge Treatment and Target Abatement Dates

Pawcatuck River Basin ((15,48))
(Cont'd)

Discharge Number	Segment Number	Segment Class*	Name of Discharger	Treatment: Present	Treatment: Proposed	Compliance or Target Abatement Date
P13	3	E	Westerly Municipal Sewage Treatment Plant	Primary	Secondary	June 1978
P14	1	W	Watch Hill Individual Sewage Systems	None	Tie into Westerly municipal sewage treatment plant	Early 1980s (Contingent upo funding)
(Connecticut) ((3,41,47))						
P15	4	E	Pawcatuck Combined Sewers	None	Separation of sanitary sewers, retention of existing storm sewers	1978 (Estimated Conn. DEP)
P16	3	E	Yardney Electric Corp.	None	Tie into Stonington (Pawcatuck) municipal sewage treatment plant (Partial)	1978 (Estimated Conn. DEP)
P17	3	E	Harris Intertype Corp. Cottrell Division	None	Tie into Stonington (Pawcatuck) municipal sewage treatment plant (Partial)	1978 (Estimated Conn. DEP)

* E - Effluent Limitation
W - Water Quality

TABLE 9

Status of Pawcatuck River Basin Waters

In Relation to the Water Quality Goals of P.L. 92-500 ((15))

	Segment Number*	Segment Class**	Segment Length	Class B or Better By: 1975	Class B or Better By: 1978	Meets 1977 Goals by 1975	Meets 1977 Goals by 1978	Meets 1983 Goals by 1978	Meets 1983 Goals by 1983
Pawcatuck River Main Stem (from mouth at Rhodes Point to Worden Pond, incl. lower Queen's R.)	2	W	2.3 mi.		2.3 mi.		2.3 mi.	2.3 mi.	2.3 mi.
	3	E	3.0				3.0	3.0	3.0
	4	E	1.0		1.0		1.0	1.0	1.0
	5(part)	W	3.6						
	6	W	1.7		1.7		1.7	1.7	1.7
	7	E	4.4				4.4	4.4	4.4
	8(part)	W	8.0	8.0 mi.	8.0	8.0 mi.	8.0	8.0	8.0
	9	E	0.6			0.6	0.6	0.6	0.6
	10	W	3.2	0.7	3.2	0.7	3.2	3.2	3.2
	11	E	1.9				1.9	1.9	1.9
	12(part)	W	2.5	2.5	2.5	2.5	2.5	2.5	2.5
White Horn Brook	13	W	7		7		7	7	7
	14	W	2	2	2	2	2	2	2
Queen's River (upper)	17	E	0.6			0.6	0.6	0.6	0.6
	18	W	4	4	4	4	4	4	4
	19	W	8	8	8	8	8	8	8
	20	W	12	12	12	12	12	12	12
Wood River (from Pawcatuck River to Wyoming Pond)	24	E	0.7				0.7	0.7	0.7

TABLE 9

Status of Pawcatuck River Basin Waters

In Relation to the Water Quality Goals of P.L. 92-500 ((15))
(Cont'd.)

	Segment Number*	Segment Class**	Segment Length	Class B or Better By: 1975	Class B or Better By: 1978	Meets 1977 Goals By 1975	Meets 1977 Goals By 1978	Meets 1983 Goals By 1978	Meets 1983 Goals By 1983
Wood River(from Pawcatuck River to Wyoming Pond) (Cont'd.)									
	25(part)	W	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	26	W	2.4						
	27	E	1.8						
Total Segment Lengths:			73.4						
Total Class B or Better:				39.9	54.4				
Total Meeting '77 Goals:						41.1	65.6		
Total Meeting '83 Goals:								65.6	65.6

* Segment 1 omitted, see text

** E - Effluent Limitation
W - Water Quality

Segment 7 receives Discharge P11, as noted above. Upgrading of this discharge by 1978 should allow Segment 7 to attain the 1977 and 1983 goals, although, by Department of Health policy, it cannot be classified higher than C. ((15))

Segment 8 receives no discharges and is adversely affected by none, and therefore meets all goals.

Segment 9 receives only non-contact cooling water from the United Nuclear Corporation (P6), and meets all goals, but will retain its C classification for health safety reasons.

Segment 10 is, at present, only partly in compliance with its B classification. The soon-to-be-completed upgrading of Discharge P4 (Kenyon Piece Dye Works, Segment 11) will allow Segment 10 to meet all goals by 1978.

Segment 11 which, as noted above, receives Discharge P4, will meet all goals when that discharge is upgarded (November, 1976). It will remain Class C.

Segment 12 has no problems, and meets all goals.

Segment 13 will attain compliance with its B classification, and meet all goals upon elimination of the URI discharges (P2 and P3), which will occur before 1978.

Segment 14 has no problems, and meets all goals.

Segment 17 receives effluent from the Ladd School secondary sewage treatment plant. Although waters receiving this type of discharge cannot, by Department of Health policy, be classified higher than C, the segment is expected to meet all goals. ((15))

Segments 18, 19, and 20 are all no problem segments which meet all goals.

Segment 24 receives the Charbert, Inc. discharge (P7), and will meet all goals when this discharge is eliminated (December, 1976). Its C classification will be retained, as overflow to the river will be allowed in emergencies.

Segment 25 is a no problem segment which meets all goals.

Segment 26 is downgraded by the Hope Valley individual sewage disposal system discharges (P9--Segment 27), which are not likely to be eliminated before 1983.

Segment 27 receives Discharge P9, which, as noted above, will probably remain beyond 1983.

E. Allowable Waste Loads For Water Quality Segments

All of the water quality segments in the Pawcatuck Basin have either a Class A or Class B water quality classification. The nondegradation policy of the Rhode Island Department of Health prohibits any new discharges to Class A or Class B waters, and requires the eventual elimination of all discharges with the exception of non-contact cooling water. These requirements dictate that the load allocations for point source discharges to these segments will be zero for all parameters, except temperature. The three discharges to water quality segments (P2, P3 and P14) are programmed or recommended for elimination.

Federal regulations also require the establishment of total maximum daily loads for nonpoint-sources of pollution. The severity and types of nonpoint-source pollution will be investigated as part of the Section 208 areawide waste treatment management planning process, and recommendations made for abatement, if necessary. ((23:30-39))

F. Waste Load Allocations for Point Source Discharges to Effluent Limitation Segments

Designation of effluent limitation segments was made by the Rhode Island Department of Health based on their judgement as to whether or not water quality standards could be met with secondary treatment for municipal discharges and best practicable treatment for industrial discharges. The National Pollutant Discharge Elimination System (NPDES) permits issued by the U.S. Environmental Protection Agency (EPA) establish limitations on the waste load that may be placed on the receiving stream by a discharge. NPDES permits specify effluent limitations for industrial discharges based on best practicable treatment. Load allocations for municipal wastewater treatment facilities are based on the average design flow and the residual concentrations of BOD and Total Suspended Solids (TSS) expected with secondary treatment. The NPDES permit limitations are summarized in Table 10.

TABLE 10

Load Allocations For Point Source Discharges ((48))

Pawcatuck River Basin

Discharge Number	Name of Discharger	Cooling Water: Flow(MGD) Daily avg.	Cooling Water: Max. Daily Temp.(°F) Daily avg.	Industrial Process or Municipal Wastewater: Flow (MGD) Monthly avg.	BOD5 (mg/1) Weekly avg.	TSS (mg/1) Weekly avg.	Fecal Coli (MPN/100 ml.) Weekly avg.	Other or Remark
P1	Ladd School	-	-	0.23	45	45	400	
P2	URI - Boiler Blowdown	To be eliminated						Subsurface disposal
P3	URI - Treatment plant	-	-	1.2	45	45	400	Until tie-in to S. Kingstown - Narragansett regional system
P4	Kenyon Piece Dye Works	-	-	-	306ppd	306ppd	-	Per operating day
P5	American Fish Culture, Inc.	-	-	-	-	2.2kg	-	Per 100kg fish on hand per day
P6	United Nuclear Corp.	0.079	82	-	-	-	-	
P7	Charbert, Inc.	-	-	-	30ppd	70ppd	-	Per operating day
P8	Greene Plastics Corp.	0.015	80	-	-	-	-	Two discharges
		0.170	85	-	-	-	-	
P9	Hope Valley - Individual Sewers	Treatment and limitation recommendations to be made under the areawide (208) planning process						
P10	Auralux Chemical Corp.	0.010	75	-	-	-	-	
P11	New Bradford Dyeing Assoc.	-	-	3.2	434ppd	780ppd	2500(total coli.)	Per operating day Phenols = 0.005 mg/1. Total Chrome = 0.01 mg/1. Surfactants = 16ppd. D.O.(summer months) = min.: 3.0 ave.: 4.0 mg/1.
P12	Ashaway-Individual sewers	Not determined - to be eliminated						
P13	Westerly Municipal Sewage Treatment Plant	-	-	3.3	45	45	400	Upon completion of upgraded sewage treatment plant
P14	Watch Hill-Individual sewers	Not determined - to be eliminated						
P15	Pawcatuck-Combined sewers	Not determined - to be eliminated						
P16	Yardney Electric Corp. Cooling Water	0.1235	75					
	Discharge No. 001B1 Before 12/31/75	-	-	0.048	-	-	-	Zinc = 15.0 mg/1.
	After 12/31/75	-	-	*	-	-	-	Zinc = 2.0 mg/1; Copper = 1.5 mg/1; $6.0 \leq pH \leq 9.0$; no visible oil sheen, foam or floating solids; no visible discoloration of receiving waters
	Discharge No. 001B2 Before 12/31/75	-	-	100gpd	-	-	-	In mg/1:Aluminum=500.0; Ammonia Nitrogen=15,000; Iron = 20.0; Tin = 5.0
	After 12/31/75	-	-	*	-	-	-	In mg/1: Aluminum = 2.0; Ammonia Nitrogen = 20.0; Iron = 5.0; Tin= 1.0; $6.0 \leq pH \leq 9.0$; no visible oil sheen, foam or floating solids; no visible discoloration of receiving waters

TABLE 10

Load Allocations For Point Source Discharges ((48))

Pawcatuck River Basin
(Continued)

Discharge Number	Name of Discharger	Cooling Water: Flow(MGD) Daily avg.	Cooling Water: Max.Daily Temp.(°F) Daily avg.	Industrial Process or Municipal Wastewater: Flow(MGD) Monthly avg.	BOD (mg/1) Weekly avg.	TSS (mg/1) Weekly avg.	Fecal Coli (MPN/100 ml.) Weekly avg.	Other or Remark
P16	Yardney Electric Corp. (Continued)							
	Discharge No.001C Before 12/31/75	-	-	0.0018	-	-	-	
	After 12/31/75	-	-	*	-	-	-	Silver=0.05 mg/1;Zinc=2.0 mg/1; $6.0 \leq pH \leq 9.0$; no visible oil sheen, foam or floating solids; no visible discoloration of receiving waters
	Discharge No.001D1 Before 12/31/75	-	-	150gpd	-	-	-	In mg/1:Iron=10.0;Total Chrome=2.0; Hexavalent Chrome=2.0;Nickel=2.0; Max.Temp=200°F
	After 12/31/75	-	-	*	-	-	-	In mg/1:Iron=2.0;Total Chrome=1.0; Hexavalent Chrome=o.1;Nickel=2.0; $6.0 \leq pH \leq 9.0$; no visible oil sheen, foam or floating solids; no visible discoloration of receiving waters; rise in stream temp. < 4°F
	Discharge No.001D2 Before 12/31/75	-	-	10gpd	-	-	-	In mg/1:Iron=200.0;Copper=75.0; Nickel=15.0; Total Chrome=50.0; Hexavalent Chrome=5.0;
	After 12/31/75	-	-	*	-	-	-	In mg/1:Iron=5.0; Copper=1.5; Nickel=2.0; Total Chrome=1.0; Hexavalent Chrome=0.1; $6.0 \leq pH \leq 9.0$; no visible oil sheen, foam or floating solids; no visible discoloration of receiving waters
	Discharge No.001E Before 12/31/75	-	-	66.7gpd	-	-	-	In mg/1:Iron=75.0;Copper=400.0; Zinc=2.0;Silver=75.0; Nickel=15.0; Aluminum=15.0;Total Chrome=15.0 Hexavalent Chrome=10.0
	After 12/31/75	-	-	*	-	-	-	In mg/1:Iron=5.0; Copper=1.5; Zinc=2.0; Silver=0.1; Nickel=2.0; Aluminum=2.0;Total Chrome=1.0; Hexavalent Chrome=0.1; $6.0 \leq pH \leq 9.0$; no visible oil sheen, foam or floating solids; no visible discoloration of receiving water

TABLE 10

Load Allocations For Point Source Discharges ((48))

Pawcatuck River Basin (Continued)

Discharge Number	Name of Discharger	Cooling Water: Flow(MGD) Daily avg.	Cooling Water: Max. Daily Temp.(°F) Daily avg.	Industrial Process or Municipal Wastewater: Flow (MGD) Monthly avg.	BOD_5 (mg/l) Weekly avg.	TSS (mg/l) Weekly avg.	Fecal Coli (MPN/100 ml.) Weekly avg.	Other or Remark
P16	Yardney Electric. Corp. (Continued)							
	Discharge No. 001F Before 12/31/75	-	-	60gpd	-	-	-	Mercury = 0.1 mg/l
	After 12/31/75	-	-	0	-	-	-	
	Discharge No. 001G Before tie-in to Stonington sewers	-	-	0.00834	200	200	-	
	Discharge No. 001H	-	-					Boiler Blowdown
	Before tie-in to Stonington sewers	-	-	0.0001				Rise in stream temp. ≤ 4°F
	Discharge No. 001I Before tie-in to Stonington sewers	-	-	113gpd	-	-	-	
P17	Cottrell Division, Harris Intertype Corp. Before tie-in to Stonington sewers	0.005	85	0.0125	200	200	-	Includes 500 gpd boiler blowdown - Max temp. = 200°F; Rise in stream temp. ≤4°F
	After tie-in	0.005	85	0.0005	0	0	-	Boiler blowdown - max.temp.=200°F Rise in stream temp. ≤ 4°F

* To be determined from Engineering Report

PART FIVE: MUNICIPAL FACILITIES REQUIREMENTS

A. Municipalities

Existing municipal sewerage facilities and those currently under construction, those which have been designed, and those which have been recommended in engineering reports are shown on Figure 8, along with their service areas. Figure 8 also indicates those general areas (high and medium density residential, commercial, industrial, airports, government-institutional) which will require sewerage service if development occurs in a pattern consistent with that proposed by the State Land Use Policies and Plan (see Figure 5, page III-7). These facilities, which are required if significant industrial, municipal and individual wastewater discharges are to be eliminated or adequately treated, are described below on a town by town basis.

1. Town of Charlestown

The only identified discharge to Charlestown waters at the present time is the United Nuclear Corporation cooling water discharge (P6). No wastewater treatment facilities, other than individual sewage disposal systems, are currently operating, programmed or under construction in the town.

If industrial and medium-density residential development occur as proposed in the 1990 state land use plan (See Figure 8), municipal facilities may be required in three areas of the town: an industrial area at Wood River Junction (Richmond town line), an area of seasonal development near Charlestown Beach, and the Shannock-Kenyon area along the Pawcatuck River (Richmond town line). Industrial and medium-density residential development in these areas, as proposed in the state land use plan, are consistent with the existing Charlestown zoning ordinance. ((38)) While these areas do not require service now, local soil conditions, the nature and density of future development, and other factors will determine the need for sewerage facilities in the future. When necessary, this basin plan will be revised to reflect changing conditions.

2. Town of Exeter

The Ladd School is the only identified discharger in Exeter. According to the Rhode Island Department of Health, this sanitary wastewater discharge is presently receiving adequate secondary treatment. ((15))

The state land use plan (See Figure 5, page III-7) calls for no industrial development and only one isolated area of medium-density residential development in Exeter. The town does not have a municipal zoning ordinance to compare with the state land use plan.

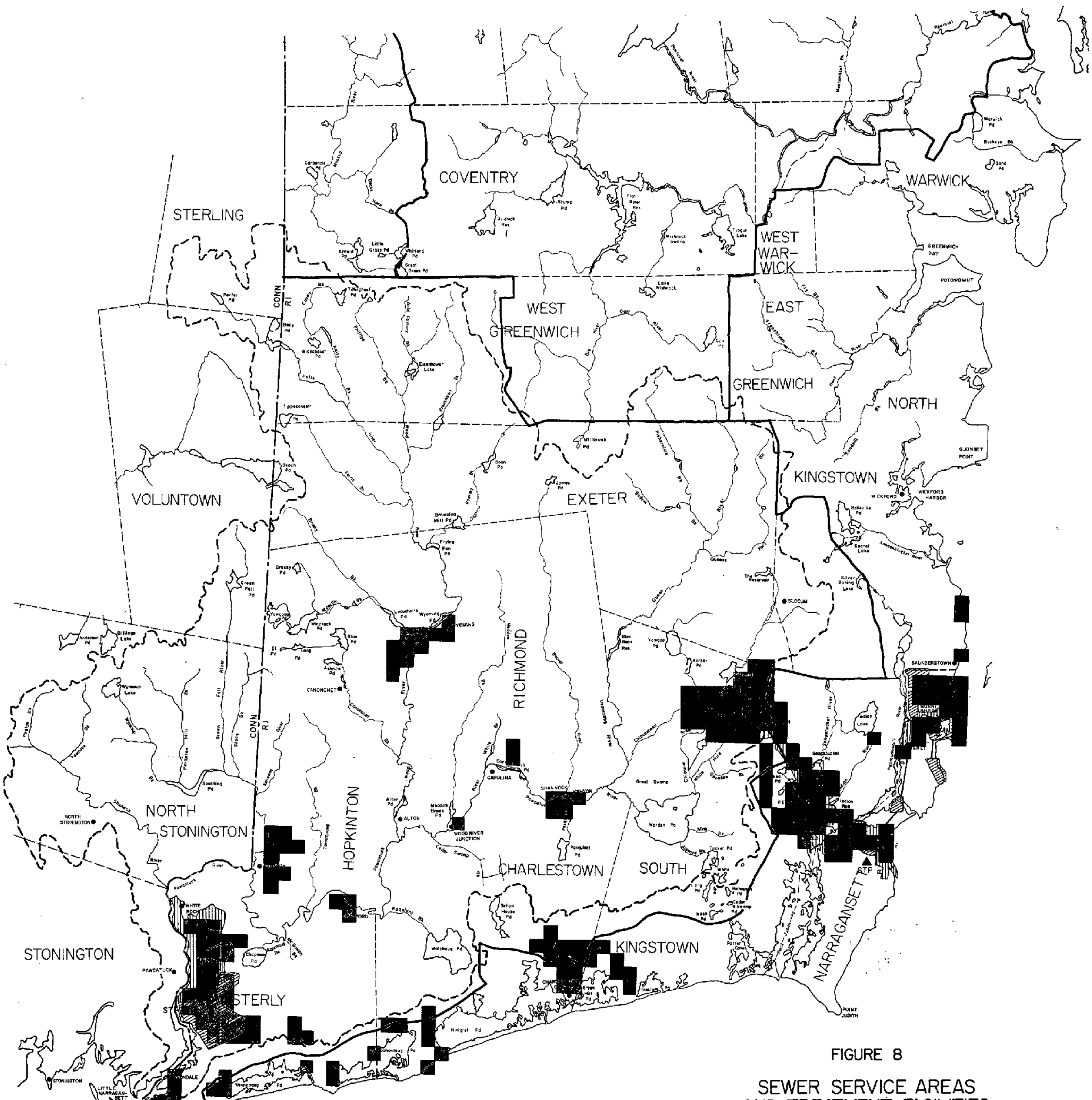


FIGURE 8

SEWER SERVICE AREAS AND TREATMENT FACILITIES

PAWCATUCK RIVER BASIN RHODE ISLAND

SERVICE AREA EXISTING OR UNDER CONSTRUCTION

AREA REQUIRING SERVICE BY 1990 (BASED ON STATE LAND USE PLAN)

SERVICE AREA PROPOSED IN ENGINEERING REPORTS

MUNICIPAL SEWAGE TREATMENT PLANT

REGIONAL SEWAGE TREATMENT PLANT

BASIN PLANNING BOUNDARY

BASIN HYDROLOGIC BOUNDARY

0 6000 12000 18000 24000 30000

SCALE IN FEET

N

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Public sewerage facilities will not be required within the time frame of this plan if development occurs consistent with the state land use plan.

3. Town of Hopkinton

There are no municipal sewerage facilities in Hopkinton at the present time. As projected by the 1969 Plan for Public Sewerage Facility Development, sewer service will probably be required by 1990 in two areas of the town. ((19:27,36)) Existing pollution problems and proposed development in Hope Valley and Ashaway support this projection.

a. Hope Valley (Wyoming)

Poorly drained soils and bedrock outcrops, which make installation of individual septic systems very difficult and expensive, have resulted in direct discharges (P9) of sanitary wastes into the Wood River at Hope Valley (See Part Two, Section D). Bedrock near the surface will also make installation of lateral sewers an expensive undertaking.

Further medium-density residential development, as recommended in the state land use plan (Figure 8), when combined with recent residential development, may aggravate an already undesirable situation. In addition, the Hopkinton zoning ordinance permits light industrial development immediately south of the village. ((39)) Such development would be consistent with the state land use plan's proposal that the Hope Valley area be developed as an outlying small urbanized area. Industrial land use in the Hope Valley area does not appear on Figure 5 and Table 5 (pages III-7 and III-8) because of the coarseness of the 92-acre grid cells used. Development induced by such zoning and by construction of the proposed I-95/I-895 highway interchange (Figure 6, page III-9) near the existing residential-commercial nucleus in the adjacent village of Wyoming (Richmond) may heighten the need for public sewers. Provision of public water service to the Hope Valley area by about 1990, as discussed in the 1969 Plan for the Development and Use of Public Water Supplies ((20: 40,47,55)), may also induce development. The groundwater reservoir underlying the village (Figure 2, page I-3) may take on major significance as a public water supply.

The 1970 population of Hope Valley (Analysis Zone 175) was 1,326. ((33:12)) This figure may grow to about 2,000 persons by 1995, if one-third of the projected growth for Hopkinton (1,900 persons) is concentrated in Hope Valley.

This projected figure for village growth seems reasonable in light of the fact that the only other significant concentrations of population are in Ashaway Village and in the area immediately across the river from Bradford. If the per capita per day sewage flow is assumed to be 100 gallons, then as much as 200,000 gallons per day might be generated in Hope Valley by 1995, exclusive of commercial and industrial flows.

Innovative solutions to pollution control in the Hope Valley-Wyoming area will be required in the near future given existing problems, projected development pressures, and the presence of sensitive groundwater resources in the immediate vicinity. The Rhode Island Department of Health has recommended that the need for sewers in the Hope Valley area be studied in detail under the Section 208 areawide waste treatment management planning process ((11: Section IIA)) scheduled for completion in 1978. Specific recommendations for pollution control techniques and protection of groundwater supplies in Hope Valley-Wyoming should be forthcoming as part of the 208 plan. The technical and economic feasibility of providing a municipal sewerage system for the area should be studied. ((23:23))

b. <u>Ashaway</u>

The existing water quality problems caused by individual sewage system discharges (P12) to the Ashaway River from the Ashaway Village area (see Part Two, Section D) require that installation of municipal sewerage facilities be programmed. Although pressure for additional development in Ashaway does not appear as great as in the Hope Valley area of Hopkinton, public water service has been projected for 1980 ((20: 40, 43, 47, 55)), and additional medium-density residential development has been proposed for 1990. (Figure 5, page III-7) The 1969 <u>Plan for Public Sewerage Facility Development</u> projected that sewerage service would be necessary in Ashaway by 1990. ((19: 27,36)) The population served could approach 2,300 by 1995. This total would result if one-third (600 persons) of the total town growth is added to the estimated 1970 village (Analysis Zone 178) population of 1,675. ((33: 12)) Nineteen-ninety-five sewage flows would be about 230,000 gallons per day, if 100 gallons per capita per day is assumed. This figure does not include commercial and industrial flows.

Although the state land use plan proposes no major industrial or commercial development in the Ashaway area, municipal zoning does permit industrial uses in one small area of the village, as well as a large area of commercial development north of the village at the I-95/Route 3 interchange (See Figure 6, page III-9).

The Rhode Island Department of Health proposes that a system of interceptor and collector sewers be installed in the Ashaway area and connected to the Westerly municipal system at White Rock village (across the Pawcatuck River to the southwest about three miles). No design, scheduling, or funding details have been established. ((15))

4. Town of North Kingstown

There are no identified pollution sources nor public sewerage facilities in the Pawcatuck Basin portion of North Kingstown at present, nor did the Plan for Public Sewerage Facility Development project a need for sewers in the area during the study period. ((19:11)) Public water service was projected for the area by 1980, according to the Plan for Development and Use of Public Water Supplies. ((20:40))

a. Slocum

Rhode Island Water Resources Board records indicate that the Village of Slocum, near the Exeter town line, was supplied with public water service from the North Kingstown Water Department in 1971. The service area includes the proposed Slocum industrial park near the main rail line ("Shore Line") (Figure 6, page III-9). While industrial development is consistent with municipal zoning in the area ((39A)), the state land use plan proposes only open space uses (Figure 5, page III-7), based on restraints to development, including the existence of prime agricultural land. ((32: 44-62))

North Kingstown's Community Development Plan of 1972 recognizes the difficulties in developing this site for industry, given: the potential for industrial pollution of nearby groundwater reservoirs (Figure 2, page I-3), the high agricultural value of the site, and the desirability of maintaining a stock of open space in the town. From the town's point of view in 1972 economic advantages outweighed the difficulties. ((10: 172,173,190)) However, the release of Navy land in North Kingstown since 1972 makes it likely that industrial development needed for the town's economic well-being will be concentrated at Quonset Point. The need for and likelihood of industrial development at Slocum is thereby reduced significantly.

In light of this fact, and in accordance with the state land use plan, it is recommended that land use in the Slocum area remain generally agricultural, and without public sewer service.

b. Saunderstown

Sewer service to the populated Saunderstown area of North Kingstown may be needed in the next few years. The 1969 Plan for Public Sewerage Facility Development projected public sewer service by 1990. ((19:27)) The area already has public water service. ((20:40)) The state land use plan proposes medium-density residential development in the area by 1990 (Figure 5, page III-7). Analysis Zone 301, which includes Saunderstown, had a population of approximately 774 persons in 1970, with an average gross density of about 1.24 persons per acre. ((33:15)) The density in the village itself can be assumed to be substantially higher than the zone average. Connection of the Saunderstown area to western portions of the state via the proposed Interstate 895 (Figure 6, page III-9) may increase development pressure in the village.

The Division of Water Pollution Control of the Department of Health has recommended that the need for public sewerage facilities in Saunderstown be studied under the Section 208 areawide waste treatment management planning program, with consideration being given to tying Saunderstown into the Narragansett sewerage system. ((14))

5. Town of Richmond

There are no public sewerage facilities and no water quality problems in the town, at present. None of the three pollution sources identified in the community is expected to require municipal treatment, as one (P5) has adequate treatment and minimal impact on water quality, one (P4) is scheduled for upgrading, and the third (P7) is scheduled for elimination (see Table 8, page IV-15).

As noted in Part Three, Section B, the state land use plan has proposed that population growth be concentrated in three areas of the town (see Figure 5, page III-7): Wyoming (Hope Valley), Shannock-Kenyon, and Carolina.

a. Wyoming (Hope Valley)

Wyoming village in the northwest part of town, forms the Richmond portion of the Hope Valley-Wyoming area, a continuous, settled area on the banks of the Wood River (Richmond-Hopkinton line) at the intersections of Routes 138, 3, and I-95. Development in Wyoming includes a cluster of interstate highway-oriented commercial establishments: several gasoline service stations, a motel and a large restaurant. A small shopping center serves Wyoming and Hope Valley, including recent medium-density residential development.

The proposed Interstate Highway 895, designed to carry heavy cross-state traffic now on R.I. Route 138, would intersect with I-95 near the village (Figure 6, page III-9). Municipal zoning near I-95 includes industrial, general business, and medium-density residential zones ((40)), which are consistent with the state land use plan's recommendation that the Wyoming-Hope Valley area continue to develop as an outlying center (See Figure 5, page III-7). Public water service is projected for the area by 1990 in the Plan for the Development and Use of Public Water Supplies. ((20:40,47,55))

Should these development pressures combine with concentrated urban growth in the village, as proposed by the state land use plan, 1995 domestic sewage flows might reach 80,000 gallons per day, which is considerably higher than the 50,000 gallons per day projected for 1990 for Wyoming by the Plan for Public Sewerage Facility Development. ((19:37))

Although no population data is available for Wyoming Village specifically, the estimated 1970 population of Analysis Zone 505 (which includes the village) was 422 persons. ((33:20)) There is no other center of concentrated population in the zone, as most of the area is in open space use as agricultural or state managed land. An estimate of 300 persons in the village itself seems reasonable. A 61.5 percent population increase of 1,600 is projected for the Town of Richmond from 1970 to 1995 (See Table 4, page III-2). If growth is distributed equally among Wyoming, Alton-Wood River Junction, and Shannock-Kenyon, perhaps one-third will concentrate in Wyoming. If Wyoming's increase is housed in medium-density residential development consistent with the state guide plan, the population needing sewer service could increase by 500. The 1970 estimate and this 1995 projection total 800 persons which may need sewer service by 1995. Assuming sewage flows of 100 gallons per capita per day, as much as 80,000 gallons per day might be generated, exclusive of commercial and industrial flows. This projection, combined with a projected domestic flow of 200,000 gallons per day (2,000 persons) from Hope Valley (See page V-3 above), totals nearly 0.3 million gallons per day, not including commercial and industrial flows. Commercial and industrial flows could add significantly to this figure if industrial development and further highway-oriented business development are induced by local zoning and the proposed I-895 interchange.

The 1969 Plan for Public Sewerage Facility Development projected that the Hope Valley-Wyoming area would need sewer service for about 1,500 persons by 1990, with a flow of 0.15 mgd. ((19:36,37)) As calculated above, the estimated 1995 served population of 2,800 and a flow of 0.28 mgd (exclusive of commercial and industrial flows) seems reasonable and supports the findings of the 1969 plan. Sewer service will be needed in the Hope Valley-Wyoming area by 1995.

A more detailed projection of 1995 flows should be prepared, and analyses of alternative sewerage system configurations should be made. This work is within the scope of the 208 areawide plan. ((23: 23,24))

b. Shannock-Kenyon

Development pressure does not appear as great in this southeastern village area of Richmond as in the northwestern area around Wyoming. However, public water service is projected for 1980 for this area, which lies along the Pawcatuck River at the Charlestown line. ((20: 40,55)) The state land use plan for 1990 proposes a concentration of low-and medium-density residential development (Figure 5). The area (Analysis Zone 508) encompasses about one-third (891 persons) of the town's population, at a low level of density (0.14 persons per acre). ((33:20))

The municipal zoning ordinance is generally consistent with the state land use proposal, in that it provides for half-acre (medium-density) house lots in Shannock. Industrial zoning is limited to a minor industrial area to accommodate the Kenyon Piece Dye Works, which occupies land on both sides of the river at Kenyon. ((17)) Additional industrial development in the area is not anticipated. Water quality problems are limited to the soon-to-be-upgraded Kenyon Piece Dye Works discharge (P4).

It does not appear likely that sewerage facilities will be required in this area within the time period of this basin plan (to 1995). However, the Shannock-Kenyon area is underlain by a significant groundwater reservoir (Figure 2, page I-3), which should be protected from degradation. Water quality, growth, and land use patterns in the area should be observed over the next few years, and this basin plan revised to reflect significant changes in the area.

c. Carolina

The limited medium-density residential development in the Carolina area will not require sewer service before 1995.

d. Alton-Wood River Junction

In addition to the three areas of development discussed above, the southwestern corner of Richmond, between the Pawcatuck River, the Wood River and the Meadow Brook (Analysis Zone 507) is estimated to contain about one-third (890 persons) of the town's population. This area includes the villages of Alton and Wood River Junction. Development density is relatively low, averaging approximately 0.14 persons per acre. ((33:20)) Municipal zoning allocates much of the area to one-acre house lots, with some half-acre lots near the village centers. A significant portion of the Wood River Junction area is zoned industrial. ((40)) This area, which is along the Pawcatuck River, is served by the main rail line ("Shore Line"). The state land use plan proposes that the Alton-Wood River Junction area generally be left in open space uses (See Figure 5, page III-7), and does not reflect the existing limited residential development in the area, due to the coarseness of the 92-acre grid cells used.

Although no water quality problems or major population concentrations exist in the area now, and sewer service does not appear necessary before 1995, future development patterns should be observed as to their effect on water quality. Particular attention should be devoted to protection of the adjacent groundwater aquifer (See Figure 2, page I-3).

6. Town of South Kingstown

The only discharges identified in the Pawcatuck Basin portion of South Kingstown are those of the University of Rhode Island. The URI boiler blowdown discharge (P2) reportedly will be eliminated by in-ground disposal. ((15)) The URI secondary sewage treatment plant (Discharge P3) serves the only sewered area in the town (See Figure 8 above). The remainder of the town is currently dependent solely upon individual subsurface disposal systems, which may be degrading the quality of groundwater, particularly in the West Kingston area. ((15))

a. URI-Kingston-Wakefield-Peace Dale

A new sewerage system is currently under construction for the Town of South Kingstown. This system will connect the existing URI system (currently undergoing expansion) to a new system of laterals in Kingston Village and the Wakefield-Peace Dale area (See Figure 3, page II-5) and Figure 8, page V-2). The treatment facility for the South Kingstown system is under construction in the Town of Narragansett. This activated sludge secondary treatment plant has a design capacity of 4.13 mgd. ((9:21)) Sludge will be dewatered, chemically stabilized, and disposed of by landfill at an existing septage disposal site in South Kingstown. An estimated 20 cubic yards of filter cake will be produced daily when the system is in full operation. ((15))

The treatment plant was originally designed to handle flows, to the year 1995, from South Kingstown and the Pier area of Narragansett only.((9)) After the plant's design capacity of 4.13 mgd had been established, South Kingstown agreed to also accept wastewater from the North End of Narragansett. ((36A:9)) This action will cause the plant to reach design capacity by about 1990. ((36B)) Table 11 presents the projected flows for the system in its expanded configuration. The South Kingstown sewage treatment plant may reach its design capacity even before 1990, if the village of West Kingston must be served by the system. This possibility is discussed below.

b. West Kingston

The new South Kingstown sewerage system is not programmed to serve the West Kingston area, nor did the Plan for Public Sewerage Facility Development project sewer service to the area before 1990.((19:27)) However, sewer service to this area may be needed to protect the underlying groundwater aquifer. Water supplies for the University of Rhode Island, the Kingston Fire District, and individual industrial and domestic systems depend upon this aquifer (Figure 2, page I-3). Additional water supply demands will be placed upon the aquifer if public water service is extended to West Kingston, as projected for 1980.((20:40)) Rhode Island Department of Health records indicate that some degradation of wells in West Kingston may already be occurring, probably from individual subsurface sewage disposal systems. ((15))

The state land use plan for 1990 proposes a major expansion of the existing industrial park immediately west of URI (See Figure 5, page III-7). As Figure 6 on page III-9 shows, this area has rail freight service, and may be served by the proposed Interstate 895, as noted in Part Three, Section B. Additional light industrial development would be consistent with current development and municipal zoning in the West Kingston area. ((41))

Increased industrial activity at the industrial park; additional residential and related commercial development; and existing institutional activities, including the Washington County Courthouse and the University of Rhode Island, may place excessive pressure on the limited capacities of the soil for both water supply and sewage disposal.

TABLE 11

South Kingstown Secondary Sewage Treatment Plant

Revised Flow Projections (1990)
((9:10,12,21))((36A:67))((36B))((26:20,26))

	1976				1990				
	South Kingstown URI	South Kingstown Villages	Narragansett Pier	Region Total	South Kingstown URI	South Kingstown Villages	Narragansett Pier	Narragansett North End	Region Total
Projected Total Town Population	21,200		9,600	30,800	23,000*		10,800**		33,800
Served Population									
Winter	12,000	9,100	3,040	24,140	15,300	11,300	3,400	10,000	40,000
Summer	8,000	9,100	8,450	25,550	10,100	11,300	8,500	10,000	39,900
Annual Average	11,080	9,100	4,400	24,580	12,700	11,300	6,000	10,000	40,000
Average Daily Flow (in millions of gallons)									
Winter	1.20	1.12	0.43	2.75	1.53	1.53	0.34	0.85	4.25
Summer	0.80	1.12	0.95	2.87	1.01	1.53	0.85	0.85	4.24
Annual Average	1.11	1.12	0.58	2.81	1.27	1.53	0.60	0.85	4.25

Treatment plant design flow: 4.13 million gallons per day

* Reference 26 assumes no growth in the URI population and a lower year-round population growth rate than that assumed in the engineering report (Reference 9).

** Reference 26 assumes a lower year-round population growth rate than that assumed in the engineering report (References 36A and 36B).

In the course of preparing the Section 208 Areawide Waste Treatment Management Plan, the following will be determined: (1) the impact of further development in West Kingston on South Kingstown's water supplies, both in terms of quantity and quality; (2) projected West Kingston sewage flows (domestic, commercial, and industrial); (3) the cost of increasing the capacity of the South Kingstown regional sewage treatment system to accommodate these sewage flows. ((23A))

7. Town of Westerly

The 1969 Plan for Development and Use of Public Water Supplies projected that the entire town will have public water service by 1980. ((20: 40,55,56)) Current supplies appear to be adequate to meet development throughout the study period. ((34: 5,9)) Proposed 1990 land use as shown on Figure 5, page III-7 is generally consistent with the municipal zoning ordinance. ((43)) The Plan for Public Sewerage Facility Development anticipated that the western half of the town would have sewer service by 1990. ((19: 10)) More detailed projections of 1995 and 2025 served populations were prepared by CE Magure, Inc., in 1972, and are included in Table 12. The 1995 sewer service area as proposed in the engineering report ((7)) is shown on Figure 9.

All three of the identified discharges in the Town of Westerly are scheduled for upgrading or elimination, and are discussed in detail below.

a. Westerly Center

The Westerly municipal sewerage system is currently undergoing expansion into the White Rock section to the north of the downtown area, as well as into two small neighborhoods to the east (See Figure 9). The airport area southeast of downtown will be served by an 18" interceptor which will circumvent the urbanized area on the east and south. This interceptor will also serve the airport industrial park being developed in conjunction with the Westerly By-pass highway. As noted in Table 12, approximately 11,600 people (64 percent of the total town population) will be served upon completion of this phase of the expansion (1976). Further expansion is programmed for the built-up areas east and south of downtown (Figure 9).

Upgrading of the present municipal primary treatment plant to secondary activated sludge treatment is taking place concurrently with the first phase of service area expansion, and should be completed by June, 1978. ((15))

TABLE 12

Westerly Secondary Sewage Treatment Plant

Design Capacity Criteria ((7,8))

	1974	1976	1995 (Design Basic)	2025 (Ultimate Design)
Projected Town Population	17,250	18,000	24,000	31,000
Total Served Population	6,500	11,600	20,100[b]	30,500[b]
Original Sewered Area	6,500	6,500	7,700	8,100
Area A	-	1,600	3,200	5,700
Area B	-	3,300	6,100	11,000
Area C	-	200	400	800
Avondale-Watch Hill	-	-	2,700	4,900
Total Average Daily Flow (in millions of gallons)	1.29	1.90	3.30	4.70
Domestic	0.67	1.26	2.16[c]	3.10
Industrial & Commercial	0.14	0.24	0.54	0.75
Infiltration	0.48	0.40[a]	0.60	0.85
Total Peak Daily Flow (in millions of gallons)	2.54	4.90	7.80	11.00

a Reflects repair to Margin Street interceptor

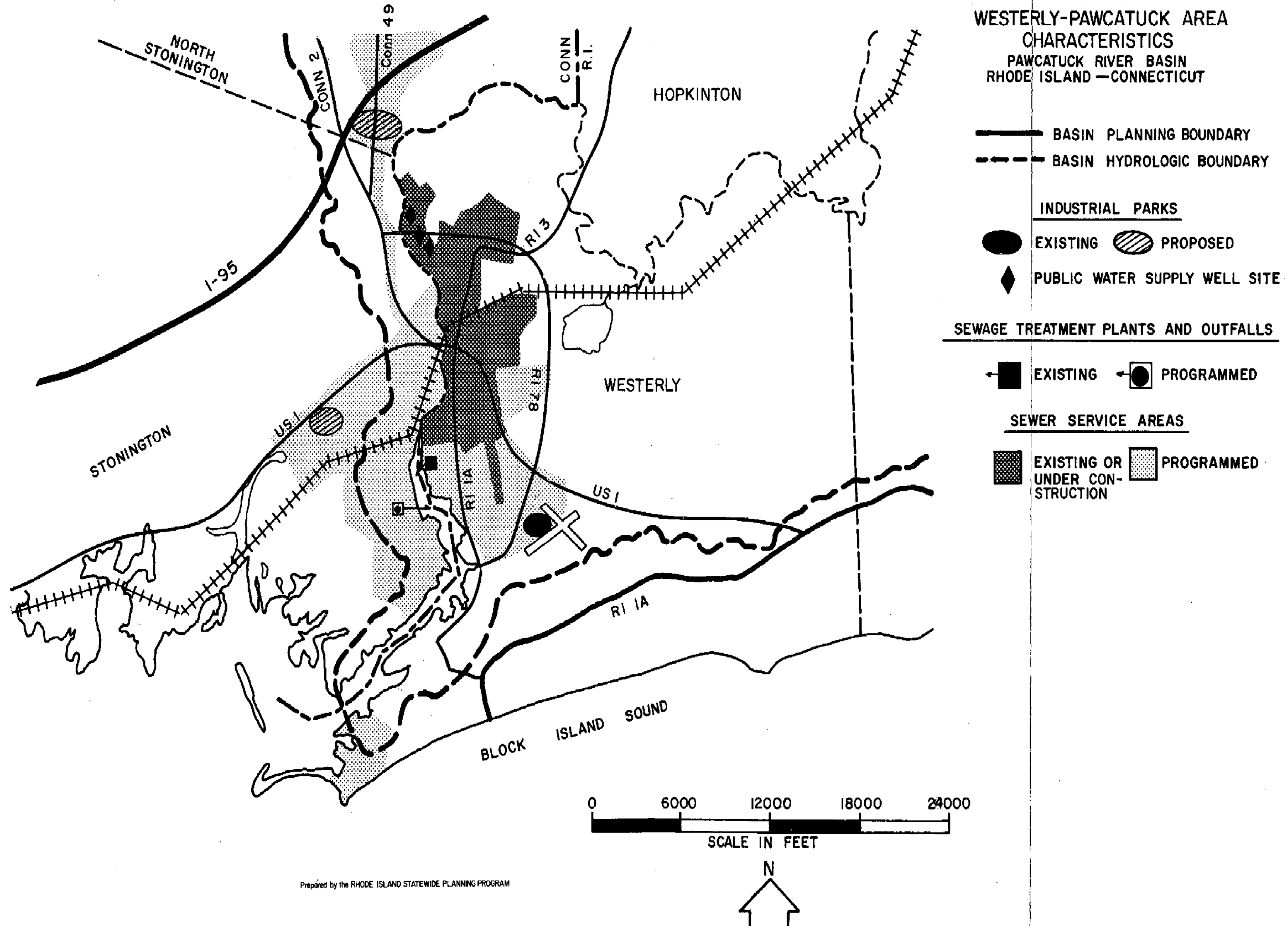
b Based on residential densities consistent with existing municipal zoning ordinance

c Includes estimated 0.27 million gallons per day from Watch Hill-Avondale area

FIGURE 9

WESTERLY-PAWCATUCK AREA CHARACTERISTICS

PAWCATUCK RIVER BASIN
RHODE ISLAND — CONNECTICUT



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This upgraded and expanded plant is designed to serve about 20,100 people or 84 percent of the projected 1995 population of 24,000 (See Table 12). The design capacity of the plant will accommodate a daily peak flow of 7.80 mgd (1995). It will utilize a conventional, activated sludge process with provisions for step-aeration and contact stabilization. This process is expected to remove 90 percent of both the biochemical oxygen demand (BOD) and the suspended solids. Sludge will be stabilized by a physical-chemical (pressurized chlorine gas) process and dewatered by vacuum filtration. Nearly 25 tons of filter cake will be produced per day by 1995. Current plans call for the disposal of the sludge filter cake through landfill operations ((7:10-22)) The facility will also provide treatment for septage.

b. Watch Hill

The Fy 1977 Rhode Island Department of Health Water Pollution Control Strategy ((13:20)) proposes that sewer service be extended to the Watch Hill area in the extreme southwestern portion of town (Figure 9) in order to protect surface and groundwater quality in the area. This proposal is consistent with the recommendation of the 1974 Facilities Plan, Westerly Sub-Basin (Alternate 1). ((35A: 23)) A detailed sanitary survey will be performed by the Department of Health later this year. ((15)) Sewage collected from the Watch Hill area would be pumped to the Westerly municipal treatment plant, ((13: 20,32)) which has been designed to accommodate these flows (Table 12). Construction of gravity sewers and force mains for the area is contingent upon the availability of local, state and federal funds, and will probably not occur until the early 1980's. ((15))

c. Bradford

The New Bradford Dyeing Association discharge (P11) will be upgraded by November, 1976. Treatment will be improved by adding acid to the discharge to neutralize its alkalinity, and will be accomplished by means of a holding pond placed between the plant and the existing lagoon. Those homes discharging domestic wastes to the lagoon will continue to do so, as the nutrients contained in these wastes aid the necessary biological activity in the lagoon. About a year will be needed to determine the success of the neutralization pond, after which aeration of the lagoon may be required if the discharge continues to degrade water quality in downstream river segments.

Both the Westerly and Hopkinton zoning ordinances permit industrial development in the Bradford area. ((39,43)) The state land use plan provides for limited industrial use in the area to accommodate existing development on the Westerly side of the river. Only low-density residential and open space uses are proposed for the Hopkinton portion of the area (see Figure 5, page III-7). If development occurs consistent with the state land use plan, sewerage service will not be needed in Bradford over the period of this plan (1975-1995).

8. Town of West Greenwich

There are no identified discharges in the Pawcatuck Basin portion of West Greenwich. Water quality throughout the area is uniformly Class A. The local Comprehensive Community Plan ((17: 32-36)) and the state land use plan (Figure 5, page III-7) propose no major areas of development in the town over the next 20 years, with the exception of water supply reservoirs. Public water service is not expected before 1990. ((20: 40,54))

Individual subsurface systems are expected to be adequate for sewage disposal until at least 1995.

9. Connecticut Communities

The Pawcatuck Basin portions of the communities of North Stonington and Stonington, Connecticut may, according to the Southeastern Connecticut Regional Planning Agency, need public sewer service by 1995. ((37))

a. North Stonington

In 1970, approximately 3,400 people lived in the Pawcatuck Basin portion of the town. Most of this population is concentrated in the Borough of North Stonington, which is under considerable residential development pressure and may require sewer service by 1990. ((37))

The Southeastern Connecticut Regional Planning Agency anticipates that if further significant development occurs on the fringes of North Stonington Borough near the proposed industrial park at the intersection of Connecticut Route 2 and Interstate 95 (Figure 9), municipal sewage collection facilities will be needed. ((37)) Current planning proposes that a portion of the wastewater (0.2 mgd) from this area be conveyed, via an interceptor, to the proposed Pawcatuck treatment plant in the Town of Stonington ((3:2)).

b. Stonington

According to the 1970 census, 15,940 people live in the Town of Stonington, with about one-third of this population (5,255 persons) concentrated in the Borough of Pawcatuck. Further development pressure is anticipated in the northern section of the borough in the area where the Westerly By-Pass highway intersects with Connecticut Route 2 (See Figure 9). ((37))

Population concentrations and the level of pollutional loading placed on the Pawcatuck River by individual sewage disposal systems and by the municipal combined storm and sanitary sewer system require that a separate municipal sanitary sewer system for Pawcatuck be installed. ((3:1-3)) EPA approved preliminary plans for the Stonington (Pawcatuck) system in 1974, as noted in Part Two, Section 7 above.

The design phase of the sanitary sewerage system has been completed and was approved by EPA in December, 1975. Construction is expected to be completed some time in 1978. ((42)) The system for Pawcatuck, as designed, will serve an initial population of 7,000 with an anticipated 1990 served population of 9,600. The 1995 design average flow for the Pawcatuck treatment plant is 1.31 mgd, including 0.2 mgd from the Borough of North Stonington, as noted above. The system will include new laterals, pump stations, force mains, interceptors and a secondary sewage treatment plant. The existing combined sewer system will continue in service as a storm sewer system. Current litigation by environmental interests is delaying the start of construction. ((42))

Sludge handling will be by digestion with land disposal at the Stonington municipal landfill adjacent to the proposed Pawcatuck treatment facility (See Figure 9).

The location of the outfall sewer from the Pawcatuck facility will be in the tidal portion of the Pawcatuck River near Gavitt Point, approximately one-half mile downstream of the Westerly treatment plant outfall (See Figure 9). ((3:1-3))

B. Project Scope and Estimated Costs for Municipal Facilities

The projected populations to be served by sewers and projected average daily flows from the systems are listed in Table 13. Estimated investment requirements for construction of needed municipal facilities are given in Table 14.

TABLE 13

Sewer Service Characteristics
Programmed for 1976

Pawcatuck River Basin

Municipality	Population (1970 census) (nearest hundred)	Projected Population Served(1976) (Annual Average)	Projected 1976 Average Daily Flow (mg) (Annual Average)	Projected 1990 Average Daily Flow (mg) (Annual Average)	Design Year
Total-South Kingstown Regional System ((9,10A))	24,000	24,580	2.81	4.25	1990
including:					
South Kingstown	16,900	9,100	1.12	1.53*	
University of Rhode Island	(Included above)	11,080	1.11	1.27	
Narragansett	7,100	4,400	0.58	1.45	
Westerly ((7))	18,000	11,600	1.90	3.30	1995
Pawcatuck Borough, (Stonington) Conn. ((3))	5,300	7,000	0.70	1.31	1995

* May be revised upward as a result of section 208 study of West Kingston's sewer needs

TABLE 14

Project Scope and Estimated Costs For Municipal Facilities ((13,15))

Municipality	Type of Project and Scope	Estimated cost (millions of dollars)	Basin Abatement Priority Ranking	Construction Grants Priority*
Westerly	Secondary Treatment Plant	6.2	under construction	
	New Collector Sewer Systems (Center)	6.3		
	New Interceptor Sewers (Center)	2.8		
	New Interceptor Sewers (Airport)	2.5	1	14
South Kingstown Regional System**	Secondary Treatment Plant	7.5	under construction	
	New Collector Sewer Systems			
	South Kingstown	10.5		
	Narragansett	8.2		
	New Interceptor Sewers			
	South Kingstown	5.1	under construction	
	Narragansett (Pier Area)	3.1		
	Narragansett (North End)	3.2	Not in basin	42
Westerly(Watch Hill)	New Interceptor Sewers	0.5	2	50
	New Collector Sewer System	1.4	3	Not. deter.
Hopkinton (Ashaway)	New Collector Sewer System New Interceptor Sewers	Not deter.	4	Not deter.
Hopkinton-Richmond (Hope Valley-Wyomimg)	Scope to be determined under Section 208 Areawide Waste Treatment Management Program	Not deter.	5	Not deter.
TOTAL ESTIMATED COSTS (Rhode Island, excluding Hopkinton and Richmond)		57.3		

TABLE 14

Project Scope and Estimated Costs For Municipal Facilities ((13, 15))
(Continued)

Municipality	Type of Project and Scope	Estimated cost (millions of dollars)	Basin Abatement Priority Ranking	Construction Grants Priority*
Stonington Conn. (Pawcatuck) ((3))	Secondary Treatment Plan	1.9	-	-
	New Collector Sewer System	Not avail.	-	-
	New Interceptor Sewers	1.8	-	-

* Numbers indicate priority ranking for project construction on a statewide basis ((13: 15-20))

** Entire system, including the portion in the Narragansett Bay Basin (see Figure 3, page II-5 and Figure 8, page V-2)

PART SIX: MONITORING PROGRAM

The Division of Water Pollution Control of the Rhode Island Department of Health is responsible for the water quality monitoring program in the state. This program consists of two types of monitoring: (1) monitoring of wastewater discharges (effluent monitoring) and (2) monitoring of instream water quality (ambient monitoring).

A. Effluent Monitoring

Effluent monitoring consists of the sampling and analysis of industrial and municipal wastewater discharges. All discharges are sampled bimonthly, except major municipal discharges which are sampled monthly and spot-checked weekly. Effluent data on certain major industrial discharges (selected by EPA) are sent to EPA for a determination of compliance with NPDES permit requirements. ((15))

The Westerly and South Kingstown (Narragansett) secondary treatment plants will be monitored monthly for: (1) turbidity, (2) BOD (5 day), (3) solids, both settleable and suspended, (4) total and fecal coliforms, and (5) metals (as necessary). Daily sampling will be performed by the plant personnel. ((12: 30-33))

B. Ambient Monitoring

Instream water quality is monitored by both trend sampling and by intensive sampling.

Trend sampling is performed at regular intervals throughout the year at each of twelve locations in the state, three of which are in the Pawcatuck Basin. These three trend sampling stations are all on the main stem of the Pawcatuck River, as shown on Figure B-1 in Appendix B. Two are in the Town of Richmond: one at the U.S. Geological Survey gaging station between Carolina and Wood River Junction, the other just downstream of the Meadow Brook confluence. The third trend sampling station is in the Town of Westerly, upstream of the Ashaway River confluence.

The chemical/physical parameters measured at least once every other month at the trend sampling stations are: (1) turbidity, (2) dissolved oxygen, (3) BOD (5 day), (4) temperature, (5) pH, (6) chlorides or salinity (7) chromium, and (8) phosphorous. Biological parameters, sampled at least once a year, are: coliform/fecal coliform bacteria, and counts and identification of periphyton, macrophyton, macroinvertebrates and fish. ((13: 45,47))

Intensive sampling is done over a twenty-four hour period at several locations in sequence down the river. The purpose of this type of survey is to show variation in water quality over the length of the river in a short time period. Wastewater discharges are also sampled and their effect on water quality determined.

Intensive sampling surveys are usually conducted for a specific purpose, rather than as a routine procedure. The purpose of an intensive sampling survey may be:

1. To obtain additional data in order to establish waste load allocations.

2. To determine a change in water quality caused by a change in a wastewater discharge.

3. To measure a change in water quality indicated by a shoreline survey.

4. To measure a change in water quality indicated by trend monitoring.

Figure B-1, page B-2, shows the locations of the intensive sampling stations surveyed in the basin in August, 1973. Selected data from that survey are given in Table B-2, page B-4.

C. Groundwater Aquifer Monitoring

In addition to the effluent and ambient monitoring programs carried on by the Division of Water Pollution Control, the Department of Health, through the Division of Water Supply, monitors groundwater quality at seven locations in the basin (see Figure B-1, page B-2).

Under this program all operating public and semi-public water supply wells are analyzed bi-weekly for color and coliform bacteria. Samples from all wells receive a complete physical, sanitary, chemical, mineral, and chlorinated hydrocarbon pesticide analysis twice each year, and a trace metal test annually. ((11: Section II-C))

PART SEVEN: RELATIONSHIP WITH OTHER PLANS

A. Federal, State, and Local Planning Coordination

The Statewide Planning Program and the Department of Health utilize a number of mechanisms, described below, to insure that the state's water quality management plans are coordinated with other federal, state, and local plans and programs.

1. Governor's Office

In 1973 a Policy and Program Review staff was created to more closely integrate the policy direction of the Chief Executive with the development activities of the operating agencies of state government. There are several agencies that make or implement policies by their respective mandates and actions. The Governor, as charged by the Constitution, is required to make short-range decisions that very often have long-range implications. An annual policy formulation process, accomplished through the coordination of state agencies with the Policy and Program Review staff will serve to link operational imperatives with long-range planning goals. The staff will work with the State Planning Council; the Statewide Planning Program staff; the Budget Office, Department of Administration; the Rhode Island Port Authority and Economic Development Corporation; the Department of Economic Development; the Department of Natural Resources; the Department of Community Affairs (particularly the Division of Planning and Development); the Department of Transportation; the Air and Water Pollution Control Divisions of the Department of Health; the Housing and Mortgage Finance Corporation; the State Energy Office; the Public Utilities Commission; and other state agencies that impact development policy in conducting this process.

2. State Planning Council

The State Planning Council assists the Statewide Planning Program in coordinating the planning and development activities of state departments and agencies, local governments and private individuals. The State Planning Council and the Statewide Planning Program are also charged with the responsibility of developing and adopting a long-range guide plan for the state. All statements of goals and policies and all elements of the State Guide Plan must be approved by the Council, following public hearings.

3. Technical Committee

Technical guidance for the Program is provided by the Technical Committee, appointed by the State Planning Council. This Committee is also comprised of state, local, private, and federal representatives. The Committee gives technical direction to the staff, reviews all work while in progress and upon completion, reviews all major reports and plans and recommends action thereon to the State Planning Council, and advises the Council on the performance of all of its functions.

4. A-95 Review Process

In Rhode Island, the Statewide Planning Program is designated as the state clearinghouse for federal and federally-assisted projects under Office of Management and Budget Circular A-95. Under this regulation, proposed federal grants and loans under designated programs, direct federal development actions, and state plans are subject to review under provisions of 1) Section 204 of the Demonstration Cities and Metropolitan Development Act of 1966, 2) Title IV of the Intergovernmental Cooperation Act of 1968, and 3) Section 102(2-c) of the National Environmental Policy Act of 1969.

The A-95 review process in Rhode Island is further strengthened by close coordination with capital improvement programming, which is designed to integrate capital acquisitions with a broad scale long-term supporting fiscal program. As part of the capital development program the Budget Division estimates the cost of total long-term needs by categories corresponding to the state's program structure. Capital needs are then reviewed relevant to the needs and priorities of the entire state. The sources of proposals for the capital development program include agency requests for capital construction, functional elements of the State Guide Plan, and recommendations of the Budget Division.

B. Regional Plan - Southeastern New England Water and Related Land Resources (SENE) Study

The SENE Study is a comprehensive federal-state planning effort being coordinated by the New England River Basins Commission.

Briefly stated, the purpose of the SENE Study is to identify and recommend actions to be taken by all levels of government and private interests to secure for the people of the region the full range of uses and benefits which may be provided by balanced conservation and development of water and related land resources. The objective of the study is to determine ways through which water and related land management can help meet two of the compelling needs of the region:

1. Sound and solid economic opportunity; and

2. A living environment of clean water, open space and beauty that enriches human dignity and enjoyment.

The SENE Study was consulted and data incorporated into this water quality management plan where appropriate. The recommendations of this plan are consistent with those of the SENE Study.((9A: 5-1))

C. State Plans

1. State Guide Plan

The State Guide Plan serves as a guide for the physical, social, and economic development of the state and provides for its long range development. All planning studies are coordinated with this long range guide plan and because the completed elements of the State Guide Plan are being placed on a continuous maintenance basis, the plan will provide an essential framework that will be responsive in evaluating relevant capital improvement proposals as well as short-term proposals that have long-range implications.

The water quality management plans for seven drainage basins (Blackstone, Moosup, Moshassuck, Narragansett, Pawcatuck, Pawtuxet and Woonasquatucket) will constitute the water quality element of the State Guide Plan. In addition to water quality, other elements cover such areas as land use, recreation, highway transportation, public transit, airports, water supply, historic preservation, and administrative facilities for state government.

This water management plan is closely interrelated with sewer and water service elements of the State Guide Plan ((19,20)), which were adopted by the State Planning Council in 1969. Frequent reference to these plans was made in the preparation of Part Five: Municipal Facilities Requirements.

Because the availability of municipal sewerage facilities can be strongly development-inducing, Part Five of this plan was also closely coordinated with the land use element of the State Guide Plan ((32)), which was discussed in detail in Part Three: Growth Potential. Because development trends are also affected by transportation services, the revised transportation guide plan element ((28)) was also considered in Part Three and Part Five.

2. Areawide Waste Treatment Management Plan

On April 23, 1975 the Governor designated the entire State of Rhode Island as a single areawide waste treatment management planning area.

The specific objectives of the Rhode Island 208 plan as outlined in the plan of study will include:

(1) the establishment of problem type, severity, and area of influence;

(2) the development or update of all needed facilities plans describing several alternative solutions;

(3) the development of sludge management plans including the handling of septic tank sludge;

(4) an inventory and assessment of the effects of combined sewers on water quality including the development of several alternative solutions;

(5) the evaluation of water quality classifications and revision where necessary, to reflect feasible uses of the water course;

(6) an evaluation and development of alternative treatment systems for industry;

(7) the identification of major non-point sources of pollution, their effect on water quality, priorities and alternatives for their consequent abatement;

(8) the determination and evaluation of groundwater pollution problems and the development of the necessary constraints to protect groundwater resources;

(9) the development of detailed soil surveys and mapping to identify areas amenable to individual sub-surface disposal and development;

(10) the review of individual community land use plans and the development of the necessary controls and constraints to regulate location and/or generation of potential non-point and point pollution sources;

(11) the review of existing studies and authorities (e.g. Blackstone Valley Sewer District Commission) for the management of wastewater. Recommend the expansion and creation of the necessary arrangement to develop the necessary agency to manage or control wastewater generations;

(12) a public participation program that will generate useable and significant input through the interaction of citizens and the 208 planning staff and public officials by the development of working committees and public meetings;

(13) an implementation program to carry out the recommended alternatives and the associated arrangements in (11) above including a self-sustaining financial program and a continuing planning process to annually update the approved final plan. ((23:1,2))

The completed 208 plan will become a part of the Continuing Planning Process and its recommendations will be implemented by a management agency to be designated in the plan.

3. Department of Health Plans

This plan was prepared in conjunction with the Division of Water Pollution Control of the Rhode Island Department of Health. The division's files ((15)) and its water pollution control plans for Fiscal Years 1975 and 1977 ((12,13)) provided extensive quantitative and background information.

4. Other State Plans

The technical and planning efforts of the Rhode Island Water Resources Board in regard to groundwater resources ((1,5)) have major significance in the Pawcatuck Basin. Demand for these vital, yet limited resources, for both in-basin and out-of basin use, may increase rapidly in the near future. The water-supply significance of these aquifers, their locations in relation to development, and their interrelationship with surface water quality and use have been considered throughout this plan.

The 1973 Interim Basin Plan for the Eastern Connecticut Coastal Basin (Pawcatuck) Including the Town of Stonington and Westerly Rhode Island, prepared by the Connecticut Department of Environmental Protection ((3)), provided the information on Connecticut communities presented in this plan. This information was supplemented by discussions with the Southeastern Connecticut Regional Planning Agency, Norwich.

As noted in Part Two, Section B above, the U.S. Environmental Protection Agency approved preliminary plans for a separate treatment facility for Stonington, Connecticut in 1974. As a result of this decision by EPA, the Pawcatuck Basin has been, for most basin planning purposes, divided into two separate sub-basins: one in Rhode Island and one in Connecticut. The information on basin planning in Connecticut is presented herein so that the reader may have as full a picture as possible of water quality planning throughout the Pawcatuck watershed.

D. Local Plans

Facilities plans and engineering reports prepared for the Town of Westerly ((4,7)) and for the South Kingstown (Narragansett) regional system ((9)) provided much of the technical data contained herein. Their findings have been incorporated into this basin plan. Comprehensive community plans and local zoning ordinances were consulted and incorporated, particularly in the preparation of Part Five.

E. Uses of This Plan

This plan, which serves to coordinate water quality management planning on a basin-wide scale, can also provide guidance for the planning of related public facilities in the basin. Recommendations made in future revisions of other elements of the State Guide Plan and other state level plans should be considered in the light of those made herein. This coordination is particularly important for other development-inducing public services, particularly transportation and public water.

Planning at the municipal level may make use of this plan and other elements of the State Guide Plan in encouraging desirable growth patterns within the community as well as in assuring the highest quality environment and public facilities possible. This plan sets forth recommendations which have significant implications for municipal economies, growth patterns, infrastructure and fiscal programs. In doing so, this plan serves to keep local interests abreast of planning at the state level - planning which can affect the future of municipalities for many years to come.

APPENDIX A

STATE OF RHODE ISLAND
AND
PROVIDENCE PLANTATIONS

DEPARTMENT OF HEALTH
DIVISION OF WATER SUPPLY AND POLLUTION CONTROL

STANDARDS OF QUALITY FOR CLASSIFICATION
OF WATERS OF THE STATE

1973

GENERAL POLICY

The following are the standards of water quality adopted for use in the classification of the waters of the state. In classification of the waters, consideration is given to all factors involved including public health, public enjoyment, propagation and protection of fish and wildlife, and economic and social development. Classifications are not intended to permit indiscriminate waste disposal or to allow minimum efforts of waste treatment under any circumstances.

In the discharge of waste treatment plant effluents to the receiving waters, cognizance shall be given both in time and distance to allow for mixing of effluent and stream. Such distances required for complete mixing shall not affect the water usage Class adopted but shall be defined and controlled by the regulatory authority.

FRESH WATER

CLASS A — Suitable for water supply and all other water uses; character uniformly excellent. (See Note 10)

1.	Dissolved oxygen	75% saturation, 16 hours/day 5 mg/1 at any time
2.	Sludge deposits--solid refuse --floating solids, oils, and grease--scum	None allowable
3.	Color and turbidity	None other than of natural origin. Not to exceed 5 Jackson units.
4.	Coliform bacteria per 100 ml	Not to exceed a median of 100 per 100 ml nor more than 500 in more than 10% of samples collected
5.	Taste and odor	None other than of natural origin
6.	pH	As naturally occurs
7.	Allowable temperature increase	None other than of natural origin
8.	Chemical constituents	(See Note 5)
9.	Fecal coliform bacteria per 100 ml	(See Note 13)

CLASS B Suitable for bathing, other recreational purposes, agricultural uses, industrial processes and cooling; excellent fish and wild life habitat; good aesthetic value; acceptable for public water supply with appropriate treatment.

Standards of Water Quality

1.	Dissolved oxygen	75% saturation, 16 hours/day 5 mg/l at any time
2.	Sludge deposits-- solid refuse --floating solids, oils, and grease--scum	None allowable
3.	Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this Class. Not to exceed 10 Jackson units.
4.	Coliform bacteria per 100 ml	Not to exceed a median of 1,000 nor more than 2,400 in more than 20% of samples collected
5.	Taste and odor	None in such concentrations that would impair any usages specifically assigned to this Class nor cause taste and odor in edible fish
6.	pH	6.5 - 8.0
7.	Allowable temperature increase	Only such increases that will not impair any usages specifically assigned to this Class (See Note 6)
8.	Chemical constituents	(See Note 5)
9.	Fecal coliform bacteria per 100 ml	(See Note 13)

CLASS C — Suitable for fish and wild life habitat; recreational boating, and industrial processes and cooling; good aesthetic value.

Standards of Water Quality

1.	Dissolved oxygen	Minimum 5 mg/l any time. Normal seasonal and diurnal variations above 5 mg/l will be maintained. For sluggish eutrophic waters, not less than 4 mg/l at any time. Normal seasonal and diurnal variations above 4 mg/l will be maintained
2.	Sludge deposits--solid refuse --floating solids, oils, and grease--scum	None (See Note 7)
3.	Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this Class. Turbidity shall not exceed 15 Jackson Units.
4.	Coliform bacteria per 100 ml	None in such concentrations that would impair any usages specifically assigned to this Class
5.	Taste and odor	None in such concentrations that would impair any usages specifically assigned to this Class nor cause taste and odor in edible fish
6.	pH	6.0 - 8.5
7.	Allowable temperature increase	Only such increases that will not impair any usages specifically assigned to this Class (See Note 6)
8.	Chemical constituents	(See Note 5)

CLASS D Suitable for navigation, power, certain industrial processes and cooling, and migration of fish; good aesthetic value.

Standards of Water Quality

1.	Dissolved oxygen	A minimum of 2 mg/l at any time
2.	Sludge deposits--solids refuse --floating solids, oils, and grease--scum	None (See Note 7)
3.	Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this Class
4.	Coliform bacteria per 100 ml	None in such concentrations that would impair any usages specifically assigned to this Class
5.	Taste and odor	None in such concentrations that would impair any usages specifically assigned to this Class
6.	pH	6.0 - 9.0
7.	Allowable temperature increase	None except where the increase will not exceed the recommended limits on the most sensitive water use and in no case exceed 90°F
8.	Chemical constituents	(See Note 5)

NOTES:

1. These Standards do not apply to conditions brought about by natural causes.

2. Class D waters will be assigned only where a higher water use Class cannot be attained after all appropriate waste treatment methods are utilized. Appropriate waste treatment shall be secondary treatment with disinfection or the equivalent.

3. All sewage treatment plant effluents shall receive disinfection before discharge into a watercourse.

4. Any water falling below the standards of quality for a given Class shall be considered unsatisfactory for the uses indicated for that Class. Waters falling below the standards of quality for Class D shall be Class E and considered to be in a nuisance condition.

5. Chemical Constituents

   a. Waters shall be free from chemical constituents and radioactive materials in concentrations or combinations which would be harmful to human, animal, or aquatic life for the appropriate most sensitive and governing water class use.

   b. In areas where fisheries are the governing considerations and approved limits have not been established, bioassays shall be performed as required by the appropriate agencies. The latest edition of the federal publication <u>Water Quality Criteria</u> will be considered in the interpretation and application of bioassay results.

   c. Phosphorus Concentration - none in such concentration that would impair any usages specifically assigned to said Class. New discharges of wastes containing phosphates will not be permitted into or immediately upstream of lakes or ponds. Phosphates shall be removed from existing discharges to the extent that such removal is or may become technically and reasonably feasible.

d. For public drinking water supplies, the limit prescribed by the United States Public Health Service will be used where not superceded by more stringent signatory state requirements.

6. The temperature increase shall not raise the temperature of the receiving waters above the recommended limit on the most sensitive receiving water use and in no case exceed 83^{o}F. In no case shall the temperature of the receiving water be raised more than 4^{o}F.

7. Sludge deposits, floating solids, oils, grease and scum shall not be allowed except for such small amounts that may result from the discharge of appropriately treated sewage or industrial waste effluents.

8. The minimum average daily flow for seven consecutive days that can be expected to occur once in ten years shall be the minimum flow to which the standards apply.

9. Class B and C waters shall be substantially free of pollutants that:

   a. Unduly affect the composition of bottom fauna,

   b. Unduly affect the physical or chemical nature of the bottom,

   c. Interfere with the propagation of fish.

10. Class A waters in use for drinking water supply may be subject to restricted use by State and local authorities.

11. The latest edition of Standard Methods for Examination of Water and Wastewater, APHA, will be followed in the collection, preservation, and analysis of samples. Where a method is not given, the latest procedures of the American Society for Testing Material (ASTM) will be followed.

12. No new waste discharges will be allowed into Class A or B waters.

13. As a guideline, pending further research, a fecal coliform criteria for Class A waters of a median of 20 per 100 ml, not more than 200 per 100 ml in more than 10% of the samples collected, and for Class B waters a median value of 200 per 100 ml, not more than 500 per 100 ml in more than 20% of the samples collected, will be used.

14. In the case of thermal discharges, where mixing zones are allowed, the mixing zone will be limited to no more than 1/4 of the cross sectional area and/or volume of flow of stream or estuary, leaving at least 3/4 free as a zone of passage.

SEA WATER

CLASS SA Suitable for all sea water uses including shellfish harvesting for direct human consumption (approved shellfish areas), bathing, and other water contact sports.

Standards of Quality

	Item	Water Quality Criteria
1.	Dissolved oxygen	Not less than 6.0 mg/l at any time
2.	Sludge deposits--solid refuse --floating solids--oil--grease --scum	None allowable
3.	Color and turbidity	None in such concentrations that will impair any usages specifically assigned to this Class
4.	Coliform bacteria per 100 ml	Not to exceed a median MPN of 70 and not more than 10 percent of the samples shall ordinarily exceed an MPN of 230 for a 5-tube decimal dilution or 330 for a 3-tube decimal dilution (See Note S.6)
5.	Odor	None allowable
6.	pH	6.8 - 8.5
7.	Allowable temperature increase	(See Note S.12)

8.	Chemical constituents	None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the waters for any other uses
9.	Radioactivity	(See Note S.8)
10.	Fecal coliform bacteria per 100 ml	(See Note S.10)

CLASS SB Suitable for bathing, other recreational purposes, industrial cooling and shellfish harvesting for human consumption after depuration (restricted shellfish area); excellent fish and wild life habitat; good aesthetic value.

Standards of Quality

1.	Dissolved oxygen	Not less than 5.0 mg/l at any time
2.	Sludge deposits--solid refuse --floating solids--oils-- grease--scum	None allowable
3.	Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this class
4.	Coliform bacteria per 100 ml	Not to exceed a median value of 700 and not more than 2,300 in more than 10 percent of the samples (See Note S.6)
5.	Taste and odor	None in such concentrations that would impair any usages specifically assigned to this class and none that would cause taste and odor in edible fish or shellfish
6.	pH	6.8 - 8.5
7.	Allowable temperature increase	(See Note S.12)
8.	Chemical constituents	None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, or impair the water for any other usage assigned to this class
9.	Radioactivity	(See Note S.8)
10.	Fecal coliform bacteria per 100 ml	(See Note S.10)

CLASS SC Suitable fish, shellfish and wild life habitat; suitable for recreational boating, and industrial cooling; good aesthetic value.

Standards of Quality

1.	Dissolved Oxygen	Not less than 5 mg/l during at least 16 hours of any 24-hour period nor less than 4 mg/l at any time
2.	Sludge deposits--solid refuse--floating solids--oils--grease--scum	None except that amount that may result from the discharge from a waste treatment facility providing appropriate treatment
3.	Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this class
4.	Coliform bacteria	None in such concentrations that would impair any usages specifically assigned to this class
5.	Taste and odor	None in such concentrations that would impair any usages specifically assigned to this class and none that would cause taste and odor in edible fish or shellfish
6.	pH	6.5 - 8.5
7.	Allowable temperature increase	(See Note S.12)
8.	Chemical constituents	None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, or impair the water for any other usage assigned to this class
9.	Radioactivity	(See Note S.8)

CLASS SD Suitable for navigation, industrial cooling and migration of fish; good aesthetic value.

Standards of Quality

1.	Dissolved Oxygen	Not less than 2 mg/l at any time
2.	Sludge deposits--solid refuse --floating solids--oils-- grease--scum	None except that amount that may result from the discharge from a waste treatment facility providing appropriate treatment
3.	Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this class
4.	Coliform bacteria	None in such concentrations that would impair any usages specifically assigned to this class
5.	Taste and odor	None in such concentrations that would impair any usages specifically assigned to this class and none that would cause taste and odor in edible fish or shellfish
6.	pH	6.5 - 8.5
7.	Allowable temperature increase	None except where the increase will not exceed the recommended limits on the most sensitive water use
8.	Chemical constituents	None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the water for any other usage
9.	Radioactivity	(See Note S.8)

NOTES:

S - 1 Sea waters are those waters subject to the rise and fall of the tide.

s.2 Class SD waters will be assigned only where a higher water use Class cannot be attained after appropriate waste treatment methods are utilized. Appropriate waste treatment shall be secondary treatment with disinfection or the equivalent.

s.3 All sewage treatment plant effluents shall receive disinfection before discharge to sea waters.

s.4 The water quality standards do not apply to conditions brought about by natural causes.

s.5 The waters shall be substantially free of pollutants that will:

a. Unduly affect the composition of bottom fauna,
b. Unduly affect the physical or chemical nature of the bottom,
c. Interfere with the propagation of fish.

s.6 Bacteriological surveys of sea waters should include sampling during periods when the most unfavorable hydrographic and pollution conditions prevail.

s.7 Any water falling below the standards of quality for a given Class shall be considered unsuitable for the uses indicated for that Class. Waters falling below the standards of quality for Class SD shall be Class SE and considered to be in a nuisance condition.

s.8 The level of radioactive materials in all waters shall not be in concentrations or combinations which would be harmful to human, animal or aquatic life.

s.9 In the case of thermal discharges, where mixing zones are allowed, the mixing zone will be limited to no more than 1/4 of the cross sectional area and/or volume of flow of stream or estuary, leaving at least 3/4 free as a zone of passage.

S.10 As a guide, pending further research, for Class SA waters a fecal coliform criteria of a median value of 15 per 100 ml not more than 10 percent of the samples exceeding 50 per 100 ml and for Class SB waters a fecal coliform criteria of a median value of 50 per 100 ml and not more than 500 per 100 ml in 10 percent of the samples collected, will be used.

S.11 No new waste discharges permitted into Class SA or Class SB waters.

S.12 Temperature increase: None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83°F or in any case raise the normal temperature more than 1.5°F, July through September and not more than 4°F from October through June.

S.13 The latest edition of the federal publication <u>Water Quality Criteria</u> will be considered in the interpretation and application of bioassay results.

S.14 The latest edition of <u>Standard Methods for Examination of Water and Wastewater</u>, APHA, will be followed in the collection, preservation, and analysis of samples. Where a method is not given, the latest procedures of the <u>American Society for Testing Materials</u> (ASTM) will be followed.

APPENDIX B

United States Geological Survey Stream Flow Gaging Station Data

and

Rhode Island Department of Health Water Quality Sampling Station Data

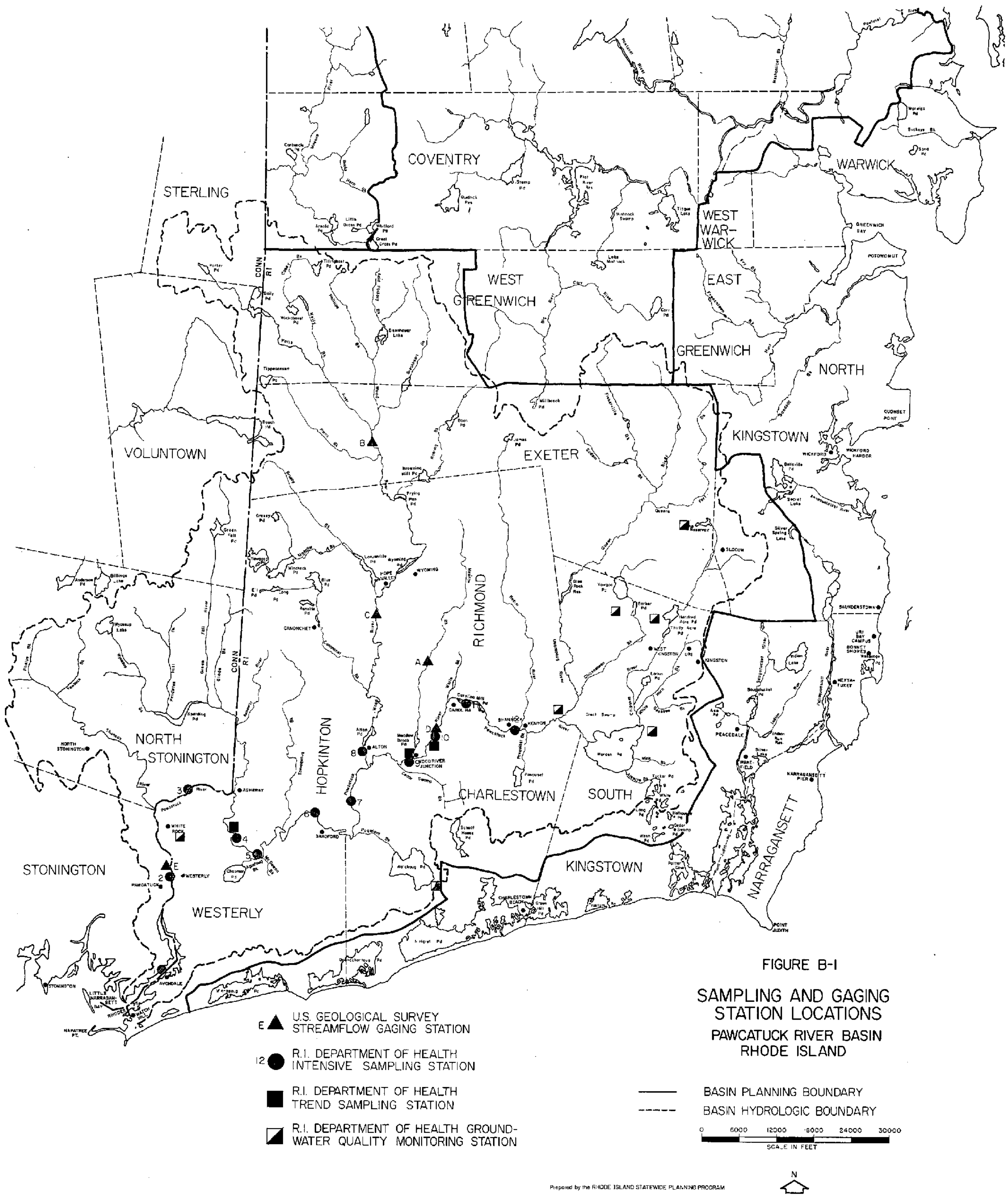

FIGURE B-1

SAMPLING AND GAGING STATION LOCATIONS

PAWCATUCK RIVER BASIN RHODE ISLAND

TABLE B-1

U.S. Geological Survey Streamflow Gaging Station Data ((46: 114-118))

Pawcatuck River Basin

Location of Gage	Drainage Area (sq.mi.)	Period of Record	Average Discharge (cfs)	1 Yr. in 10 Yr. 7 Day Low Flow (cfs)((45))
A. Meadow Brook near Carolina, R.I. (Pine Hill Road) (Station #01117600)	5.5	June'65-Sept.'73	9.9	Not Available
B. Wood River near Arcadia, R.I. (Ten Rod Road)(Station #01117800)	35.2	Jan.'64-Sept.'73	71.8	Not Available
C. Wood River at Hope Valley, R.I.(Station #01118000)	72.4	Mar.'41-Sept.'73	149.0	18.8
D. Pawcatuck River at Wood River Junction, R.I. (Alton-Carolina Road) (Station #01117500)	100.0	Oct.'40-Sept.'73	190.0	26.7
E. Pawcatuck River at Westerly, R.I.(North of Main St.) (Station #01118500)	295.0	Nov.'40-Sept.'73	564.0	63.7

TABLE B-2

R.I. Department of Health Water Quality Survey Data ((15))

Pawcatuck River Basin

August 22, 1973 (unless otherwise noted)

Station Number	Location	River Segment	River Mile	Flow (mgd)	Temp.[a] (°F)	DO[a] (mg/l)	BOD_5[a] (mg/l)	Total[a] Coliform (MPN/100ml)	Fecal[a] Coliform (MPN/100ml)	Ammonia[b] Nitrogen (mg/l)	Total[b] Copper (mg/l)	Total[b] Zinc (mg/l)
1	Green Haven Road Stonington, Conn.	2	1.3	Tidal	73 76 79	6.1 7.4 10.3	1.2 2.4 4.2	2,100 3,350 4,300	150 840 930	0.44	0.47	0.32
2	Main Street Bridge Westerly, R.I.	3	4.8	157	71 75 79	4.4 4.6 6.2	1.6 2.5 3.3	230 2,615 9,300	230 430 4,300	0.18	0.10	0.06
3	Boom Bridge Highway Bridge Westerly, R.I.	5	8.4	141	72 75 77	3.3 4.2 4.5	1.6 3.0 5.3	430 2,415 9,300	150 930 930	0.14	0.07	0.06
4	Meeting House Bridge (R.I. Route 3) Hopkinton, R.I.	6/7	11.6	138	72 75 78	3.1 3.5 3.7	1.9 3.0 3.7	750 930 4,600	73 290 430	0.16	0.07	0.06
5	Narragansett Electric Company Substation Hopkinton, R.I.	7	13.3	137	72 74 77	3.6 3.8 4.6	2.0 3.0 4.6	1,500 2,400 2,400	230 680 930	0.16	0.05	0.06
6	Bradford Road Bridge Westerly, R.I.	8	17.0	126	71 72 76	5.9 6.2 6.6	1.1 2.2 3.8	2,400 3,500 15,000	43 585 2,400	0.11	0.05	0.07
7	Burdickville Road Bridge Hopkinton, R.I.	8	20.5	-[c]	65 65 66	6.5 6.9 7.2	1.1 1.9 3.1	9,300 33,500 43,000	9,300 19,500 43,000	0.13	0.08	0.10
	Same-August 30, 1973			118	71 74 76	6.4 6.8 7.5	1.3 1.4 4.4	3,050 4,600 1,500	460 460 460	0.14	0.08	0.14
8	Wood River Alton-Carolina Road (R.I. Route 91) Richmond, R.I.	24	21.6+ 0.6	67	66 67 68	6.6 7.4 7.8	0.5 2.1 4.0	390 840 2,400	240 315 930	0.09	0.03	0.09
9	Kings Factory Road	8/9	24.0	92	65 65 65	5.8 6.6 6.9	1.5 1.8 3.0	15,000 68,000 390,000	7,500 15,000 43,000	0.17	0.05	0.07

TABLE B-2

R.I. Department of Health Water Quality Survey Data ((15))

(Continued)

Pawcatuck River Basin

August 22, 1973 (unless otherwise noted)

Station Number	Location	River Segment	River Mile	Flow (mgd)	Temp.[a] °F	DO[a] (mg/1)	BOD_5[a] (mg/1)	Total[a] Coliform (MPN/100ml)	Fecal[a] Coliform (MPN/100ml)	Ammonia[b] Nitrogen (mg/1)	Total[b] Copper (mg/1)	Total[b] Zinc (mg/1)
10	Alton-Carolina Road (R.I. Route 91) Charlestown, R.I.	10	25.3	85	64 65 66	6.4 6.5 7.0	1.7 1.8 2.5	23,000 43,000 150,000	≤ 2,300 33,000 75,000	0.20	0.07	0.10
11	Carolina Dam Charlestown, R.I.	10	27.1	82	64 66 67	5.7 7.2 7.4	1.9 2.0 2.4	15,000 84,000 460,000	9,100 32,000 43,000	0.23	0.04	0.07
12	Shannock Dam Richmond, R.I.	11	29.0	78	65 66 67	4.8 5.0 5.3	2.1 2.6 3.0	430,000 430,000 750,000	240,000 315,000 430,000	0.23	0.05	0.10

a Data tabulated presented in order: Minimum, Median, and Maximum of values obtained during a twenty-four hour sampling period. Samples taken at two-hour intervals.

b Composite of all samples collected at station.

c Error in calculation suspected.

APPENDIX C

Segment Priority Ranking System

Segment priority points are assigned by the Division of Water Pollution Control of the Department of Health on the basis of the following major criteria:

1) severity of problem;
2) need for preservation of pure waters; and
3) population affected

The priority points for the first two factors (severity of problem and preservation of pure waters) are obtained from Table C-1.

TABLE C-1

Need for preservation of high quality water (Usage)	Severity of pollution problems (water quality)			
	None	Slight	Moderate	Great
A Shellfishing & drinking water supply	0	2	6	10
B Bathing & recreation	0	2	5	8
C Propagation of fish & aquatic life	0	2	5	8
D Industrial uses	0	1	2	3

The need for preservation of pure waters is based on the usage assigned to a water body through its water quality classification. The severity of pollution problems corresponds to existing water quality conditions. For any segment, a value indicating the effect of pollution on water usage can be obtained from Table C-1 by reading across the line for a specific usage to the column which corresponds to the severity of pollution in the segment.

The third factor considered in assigning segment priority points is the population affected by the water quality of the segment. Since it is difficult to determine who is and who is not affected by the water quality in any given segment, the population affected is taken to be the population in the vicinity of the segment.

Priority points for the population affected are obtained from Table C-2.

TABLE C-2

Population Affected	Priority Points
0 - 10,000	1
10,001 - 50,000	2
50,001+	3

The total priority points for a segment would be the sum of the value obtained from Table C-1 and the value obtained from Table C-2. For example, a Class B segment with moderate pollution in a moderately populated area (10,001 - 50,000 people) would be assigned five (5) points from Table C-1 and two (2) points from Table C-2 for a total of seven (5+2) priority points.

The priority ranking for a segment within a basin corresponds to the priority points assigned to the segment by the previously described method. The segment with the greatest number of priority points receives the highest basin abatement priority ranking, a lower number of priority points would correspond to a lower basin abatement priority ranking.

Table C-3 provides a breakdown of the priority points assigned to segments in the Pawcatuck Basin.

TABLE C-3

Assignments of Segment Priority Points

Segment Identification Number	Segment Class*	Water Quality Classification (Usage)	Severity of Problem (Water Quality)	Points from Table C-1	Points from Table C-2	Segment Priority Tota (Table C-1 + Table C-2)
1	W	SA	Slight	2	2	4
2	W	SB	Slight	2	2	4
3	E	SC	Moderate	5	1	6
4	E	C	Moderate	5	1	6
5	W	B	Slight	2	1	3
6	W	B	Slight	2	1	3
7	E	C	Slight	2	1	3
8	W	B	None	0	0	X
9	E	C	None	0	0	X
10	W	B	Slight	2	1	3
11	E	C	Moderate	5	1	6
12	W	B	None	0	0	X
13	W	B	Moderate	5	1	6
14	W	A	None	0	0	X
15	W	A	None	0	0	X
16	W	A	None	0	0	X
17	E	C	None	0	0	X
18	W	A	None	0	0	X
19	W	A	None	0	0	X
20	W	A	None	0	0	X
21	W	A	None	0	0	X
22	W	A	None	0	0	X
23	W	A	None	0	0	X
24	E	C	Slight	2	1	3
25	W	B	None	0	0	X
26	W	B	Slight	2	1	3
27	E	C	Slight	2	1	3
28	W	B	None	0	0	X
29	W	A	None	0	0	X
30	W	B	None	0	0	X
31	W	A	None	0	0	X
32	W	A	None	0	0	X
33	W	A	None	0	0	X
34	W	B	None	0	0	X
35	E	C	Slight	2	1	3
36	W	A	None	0	0	X
37	E	C	None	0	0	X

*E - Effluent Limitation   W - Water Quality

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GLOSSARY

abatement-reduction of the degree or intensity of pollution.

activated sludge process-a secondary waste treatment process using biologically active sewage sludge to hasten breakdown of organic matter in raw sewage.

advanced sewage treatment-waste water treatment beyond the secondary or biological stage that includes removal of nutrients such as phosphorous and nitrogen and/or high percentage of BOD and TSS. Advanced waste treatment, known as tertiary treatment, is the "polishing stage" of waste water treatment and produces a high quality effluent.

algal bloom-a proliferation of living algae on the surface of lakes, streams, or ponds.

ambient monitoring-monitoring of instream water quality. Ambient monitoring consists of trend and intensive monitoring.

aquifer-an underground bed or stratum of earth, gravel or porous stone that contains water.

assimilative capacity-the capacity of a water body to receive waste-water discharges without violation of water quality standards.

basin abatement priority ranking-the priority ranking assigned to municipal sewerage construction projects in a river basin.

biochemical oxygen demand (BOD)-a measure of the amount of oxygen consumed in the biological processes during the breakdown of organic matter in water. Large amounts of organic waste use up large amounts of dissolved oxygen, thus the greater the degree of pollution, the greater the BOD.

best practicable treatment (BPT)-the minimum degree of treatment as prescribed by EPA. For municipal discharges, this is secondary treatment. For industrial discharges, guidelines are established by EPA for each type of industry.

BOD_5-the amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter. This value is usually obtained from a standard laboratory test.

coliform bacteria-any of a number of organisms common to the intestinal tract of man and animals whose presence in waste water is an indicator of pollution and of potentially dangerous bacterial contamination.

combined sewer-a sewer that carries both sanitary sewage and storm water.

combined sewer overflow-discharges from a combined sewer. This usually occurs during wet weather when the flow in the sewer is beyond its capacity, but can also occur during dry weather if the sewer is not properly mantained.

construction grant priority-the priority assigned to municipal sewerage construction projects on a statewide basis.

cooling water-water which has been used for cooling. Its only contaminant is heat.

dissolved oxygen (DO)-the oxygen dissolved in water. Adequate DO is necessary for the life of fish and other aquatic organisms and for the prevention of offensive odors. Low DO concentrations generally are due to discharge of excessive organic solids having high BOD.

effluent-the waste water discharged into a receiving water. The waste water may be partially or completely treated or in its natural state.

effluent limitation-any restriction established for discharge into a water body.

effluent limitation segment-a segment where application of the best practicable treatment to each discharge will result in the attainment of water quality goals.

effluent monitoring-monitoring of waste water discharges.

estuary-an area where fresh water meets salt water; for example bays, mouths of rivers, salt marshes and lagoons.

eutrophication-the aging process by which a lake evolves into a bog or marsh and ultimately disappears. During eutrophication the lake becomes rich in nutritive compounds which spur algal growth and other microscopic plant life which fill in the lake over the years.

facilities plan (201 plan)-a plan prepared by a municipality describing sewerage facilities needs and alternatives, and including an environmental assessment of the project. This plan must be prepared for the community to be eligible for a federal construction grant.

force main-(F.M.)-a sewer in which sewage is pumped under pressure rather than flowing by gravity.

hydrologic boundary-the boundary of a river basin as defined by its drainage area.

individual sewage disposal system-a sewage disposal system for a single dwelling unit or business establishment; usually a septic tank and leaching field or a cesspool.

infiltration/inflow-total quantity of water, other than sewage, entering a sewer system. Infiltration is water entering a sewer system and service connections from the ground through such sources as defective pipes, pipe joints, or manhole walls. Inflow is water discharged into a sewer system from such sources as roof leaders, drains, catch basins, manhole covers, street wash waters, etc.

intensive monitoring-ambient monitoring which is done over a twenty-four hour period at a number of locations in sequence down the river.

interceptor sewer-a sewer which collects the flows from main and trunk sewers and carries it to a central point for treatment or discharge.

lateral sewer-sewers that collect sewage from homes or businesses and which discharge into a branch or other common sewer.

most probable number (MPN)-a statistically derived estimate of the number of bacteria in a 100 ml sample of water.

non-point source discharges-a source of pollution which is not discharged through a pipe or conduit; such as stormwater runoff and leachate.

NPDES permit-a permit issued by EPA regulating the concentration of pollutants in a wastewater discharge.

nutrients-elements or compounds essential as raw materials for organism growth and development, such as nitrogen and phosphorous.

outfall-the mouth of a sewer, drain or conduit where effluent is discharged into the receiving waters.

parameter-a physical property whose value describes the condition of a water body.

pH-a measure of the hydrogen-ion activity in a liquid. pH is represented on a scale of 0 to 14 with 7 representing a neutral state, 0 representing the most "acid" state and 14 the least "acid" state.

point source discharge-a discharge of pollutants through a pipe or similar conduit.

pollution-the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.

pollution load-the amount of pollutants which are discharged to a receiving water.

pre-treatment-in waste water treatment, any process used to reduce pollution load before the waste water is introduced into a main sewer system or delivered to a treatment plant for substantial reduction of the pollution load.

primary sewage treatment-the first stage in waste water treatment in which substantially all floating or settleable solids are mechanically removed by screening and sedimentation.

receiving water-a water which receives either a point or non-point discharge.

runoff-the portion of rainfall, melted snow or irrigation water that flows across ground surfaces and eventually is returned to streams.

sanitary sewage-sewage discharging from the sanitary conveniences of dwellings, office buildings, factories or institutions.

sanitary sewers-sewers that carry domestic, commercial or industrial waste waters. Storm water is excluded from sanitary sewers.

secondary treatment-waste water treatment beyond primary treatment and providing at least 85 percent removals of BOD_5 and TSS. The most common method of secondary treatment is the activated sludge process.

segment-a section of a waterbody with common water quality characteristics and use classification. Waterbodies are divided into segments in order to facilitate the analysis and description of the impact of waste water discharges.

segment class-the classification of a segment as either an "effluent limitation" or "water quality" segment.

segment priority points-the points assigned to a segment based on the severity of pollution in the segment, the water usage assigned to the segment and the population affected by the pollution.

segment priority ranking-a ranking among the segments of a basin based upon the segment's priority points. The purpose of the ranking is to indicate the priority for pollution abatement measures within that segment.

septage-the solids and liquid which are pumped out of septic tanks.

septic tank-an underground tank used for disposal of domestic sewage. Heavy solids settle to the bottom and liquid flows into drains and then into the ground. Sludge is pumped out at regular intervals.

severity of pollution ranking-the ranking assigned to pollution sources based on the effect of the discharge on the receiving water.

sewage-the liquid wastes from residences and commercial and industrial establishments. When carried in sewers, it would also include such ground water, surface water and storm water as may be present.

sewer-any pipe of conduit used to collect and carry away sewage or storm water runoff from the generating source to treatment plants or receiving plants or receiving streams.

sewerage-the entire system of sewage collection, treatment, and disposal.

sludge-the solids removed from sewage during waste water treatment.

storm sewer-a pipe or conduit that collects and transports rain and snow runoff to a receiving water.

total oxygen demand (TOD)-the theoretical oxygen demand that would be exerted by the breakdown of organic matter in sewage and the conversion of ammonia to nitrate. TOD can be calculated by using the following formula:

$$\text{TOD (\#/day)} = 1.47\ (\text{BOD}_5) + 4.57\ (\text{NH}_3\text{-N})$$

where BOD_5 = five day BOD (#/day)
and $(\text{NH}_3\text{-N})$ = ammonia nitrogen in #/day.

trend monitoring-monitoring at regular intervals throughout the year at the same site.

trickling filter-a secondary treatment system consisting of a bed of rocks or stones that support bacterial growth. Sewage is trickled over the bed enabling the bacteria to breakdown organic wastes.

waste water-water which has been used for a particular purpose and must be disposed of.

water quality segment-a segment in which water quality standards will not be met even with the application of best practiable treatment.

ABBREVIATIONS

BOD-biochemical oxygen demand

BOD_5-5 day biochemical oxygen demand

BPT-best practicable treatment

BVDC-Blackstone Valley District Commission

CBD- Central Business District

cfs-cubic feet per second

DO-dissolved oxygen

EPA-U. S. Environmental Protection Agency

F.M.-force main

gpcd-gallons per capita daily

gpd-gallons per day

JTU-Jackson Turbidity Units

kg-kilograms

mg-million gallons

mgd-million gallons daily

mg/l-milligrams per liter

NPDES-National Pollutant Discharge Elimination System

ppd-pounds per day

P.S.-pump station

RIDOH-Rhode Island Department of Health

RISPP-Rhode Island Statewide Planning Program

TOD-Total oxygen demand

TSS-Total Suspended Solids

USGS-U. S. Geological Survey